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1919

A Retrospect.

In a few hours now we shall be at the end of a year which, for all time, will project with great prominence in the history of all nations, but more particularly in that of those who were engaged in a war which shook the whole world as it had never before been shaken, and diverted the flow of its affairs from their normal channels into abnormal ones. On Nov. 11, 1918—a day which was solemnly commemorated in the United Kingdom this year—only seven weeks before our last annual retrospect was published, the armistice was signed with the country mainly culpable for the four-and-a-half years of ghastly, destructive war; and then, after seven months' intense suspense, the Peace Treaty with Germany was signed on June 28 at Versailles, and later with Austria and Bulgaria. These events alone mark the year with a crowning importance in the history of the world. But glorious as was the victory of right and justice, successful as was the fight for the repression of an ambition for world domination, the world is not at peace. There are large tracts of it in which there is still internal war; Germany continues to protest against demands and conditions which are just in view of the measure of her iniquity; and there is discontent in countries bordering the Adriatic. The year has been filled with uninterrupted close conference between the Allies; and nothing has been left undone which could be fairly and prudently done to adjust international differences. The end is not yet. Meanwhile, allied troops are in occupation along the Rhine. Elsewhere in the battle areas, the salvage of war is being collected, and a beginning is being made with reconstruction in the devastated areas. But this beginning is hardly perceptible in the midst of the mighty havoc.

Though there is no war between nations in the western countries of Europe, there is not peace. While the war raged, the whole world was talking of the great reconstruction that was going to take place when it ended; and great things were to be done immediately. Hopes were built on shifting sands; and schemes were made with ill-calculation. Events have mocked the great plans and visionary ideals. We have been sharply and sternly reminded that the world cannot turn from terrific warfare to settled pacific conditions in a day, or in a single move. All was disorganized; and the remedy is a matter of time. But the greatest obstacle to as rapid reorganization as human skill and strength would allow has been provided by labour. Labour the world over has made the year still more notorious by the character of its demands, and the methods adopted in the effort to bring about compliance. Labour, in short, has been—apart from the financial burden and strain caused by the war—one of the primary factors in changing the whole character of the world's economic conditions. Here it has been the same as elsewhere—in some respects more so. The British gas industry has not escaped the effects. For it, as for all other home industries, money is dearer. Coal and other materials, manufactured goods, and labour are all high priced. The old standards of cost in the gas industry's operations are dead; and new ones have risen up. There is not now the slightest chance of any reproduction of the old standards and conditions. The former will always be higher, and the latter weightier and more tense, than before war came. During the year, the gas industry has been working under new and mutable conditions; and the year has also opened to its view fresh roads and new objectives. Because of this, it has been thought well to confine this retrospect more particularly to those matters which have so largely concerned us during the year, and which will make a big impression upon the future, instead of devoting space and time to matters of a more ordinary nature—not that these are unimportant. But just now with a mass of topic before us, preference must be given to those questions which are more or less creative—some beneficially, some otherwise—of those new conditions of which we have spoken.

The Dominating Question of Coal.

The year has been a bad one in respect of coal for the gas industry—indeed, for the whole of the country. It easily comes out first as the year of worst feature in the history of coal supply. There have been for the country clouds of uncertainty produced by a coal situation ever developing fresh phenomena; and it has given many shocks, the vibrations and effects of which have been felt acutely by the industry and its customers. Coal, in fact, has, during the year, been making history, much of which will be of a permanent character; and it has done a great deal, by the price to which it soared, to render industry, production, and trade sluggish through the higher costs it has imposed upon materials. It has, through its movements, contributed much to the increased cost of living, and to the making of unemployment, except within its own realm. It has been a great topic, with numerous facets; and the miners have stood out as the dominating party in it all. We have had the Coal Commission, the interminable questions of hours and wages, prices, and coal mine nationalization. There have been coal strikes; and coal output and stocks have been the grounds of constant anxiety, together with the quality of the coal.

Coal Control.

Coal control has continued throughout the year; and it is likely to do so for some time to come, but in modified form. There was great regret when the Coal Controller (Sir Guy Calthrop, Bart.) died, at an early age, in February. There had not been agreement with all he did. But all recognized the difficulties, all appreciated his sincerity and honesty of purpose, and all agreed that he did what he believed to be the best. Sir Evan Jones, Bart, who had been Petrol Controller, temporarily undertook the work; and was heartily welcomed. When he retired in the latter part of the autumn, Mr. A. R. Duncan was appointed his successor. It would have been a good thing if coal control had been removed or considerably modified in certain directions, perhaps not in connection with price, though views on this subject have had some nasty knocks one way and the other in the course of the year. That the Government eventually saw that control in all its created bearings was not working for the good of the country was indicated in several ways. For example, in connection with the great coal distribution reorganization scheme on which Sir Guy Calthrop had built so much, it was decided that, with a view to assisting in the restoration of normal conditions, the restrictions imposed on the transport of coal should be suspended as from Sept. 1. Then in the House on Nov. 24, Sir Auckland Geddes stated that it was proposed to transform the coal control machinery until it consists of three parts only: (1) Limitation of the amount of coal to be exported; (2) Limitation of coal owners' profits; and (3) Special limitation of prices of coal supplied for domestic purposes. So far so good. About the same time, something was learned as to the staff and cost involved by coal control; the authority being Mr. Bridgeman, the Parliamentary Secretary of the Board of Trade, who stated in the House that the number of officials, experts, and staff employed in the Coal Mines Department

at Oct. 31 was 859; and the cost of the Department for the ten months ending Oct. 31 was £121,900.

Reverting to the suspended coal distribution reorganization scheme, and shifting the source of information to the Coal Commission, it was stated by Mr. Frank Pick in his evidence that the Coal Controller's scheme had saved the country (we suppose that he meant in railway carriage) £2,650,000. With all due respect to Mr. Pick, we do not believe that on balance the country was saved anything of the kind. The gain on the one hand was, we are confident, more than swamped by the losses that were, on the other hand, imposed upon industry by having to take coal from other sources, and that coal so often unsuitable to requirements. This was a side of the matter that should have been controlled had the control been efficient; but, on the contrary, it was allowed to run wild. Of unsuitable coal through diversion of supplies, the gas industry obtained much, and reaped the inevitable result of inefficient working. The National Gas Council desired the Controller in the Spring to make arrangements whereby gas undertakings forced to accept coal from pits farther away from their works than the usual sources of supply should be reimbursed the additional charge for the carriage of the coal. No gas undertaking has had the felicity of enjoying reimbursement, though to inferior coal and heavier charges due to the change in the source of supply are attributable some part of the additional charges that have had to be made to gas consumers.

The Seaborne Coal Scandal.

The suspension of the coal distribution reorganization scheme did not do the gas industry much good during the latter part of the year. Contracts were running, and could not be altered. And in the middle of July there came the pernicious order as to seaborne coal being taken, wherever possible, by gas companies, power stations, and other users of manufacturing coal; and this came into operation from Aug. 1. It meant a great accession of cost to the London and southern gas undertakings (and this upon the price increase of 6s. per ton of coal). The condition was one which, being so onerous for all concerned—particularly for those along the South Coast—gave rise to considerable indignation. It meant, too, a large transference from Yorkshire coal to inferior Durham; and Durham coal has of late been forfeiting a good deal of its former high reputation. The excuse made for placing this fresh burden upon gas undertakings and gas consumers was that it was important to give to coastwise traffic, to keep the owners of boats in this particular business, a far greater tonnage of coal—transport by sea being recognized by the authorities as the only solution of the difficulties of railway transport. Yet we had by then had nearly eight months clear of the war, and of war traffic! And freights were being maintained at a much higher rate than the cost to gas companies with boats of their own. This Seaborne Order still continues; and it is totally unfair to those who have to pay.

The Central Executive Board of the National Gas Council and the President (Mr. D. Milne Watson), who, as Governor of the Gas Light and Coke Company, had on this matter the facts well at hand, has never quitted effort to get the Order abrogated, or the rates of freight modified. They have appealed to every Government Department and official who might be supposed to have influence in regard to it, even to the Prime Minister himself, but all of no avail. There has been some plain speaking. The President at a meeting of the Central Executive Board stated that the charge was made simply and solely because of the stoppage of exports of coal, coke, and patent fuel, except under the direct order of the Admiralty, and to give shippers compensatory business at rates of freight which the gas companies with their own ships knew to be extortionate. This was in July, and Mr. Milne Watson then said the rate was 12s. 6d. to the Thames, excluding unloading charges, while some of the gas companies owning vessels were carrying at 5s. 8d., and there were good vessels doing the work at between 4s. and 5s. Getting farther afield, the costs to gas undertakings in Cornwall ran up to 35s. per ton for freight. This is nothing but gross injustice. Gas companies are heavy ratepayers, and with the railways subsidized they are as much entitled to their use as anyone else. Meetings were held of representatives of the interested undertakings; and discussion and effort continued without halt. As an instance of what the impost meant to a company no worse situated than the South Suburban, it may be mentioned that the transfer of the source of supply of coal from the Midlands, whence it came by rail, to the North, whence it came by sea, would (at the time) have cost consumers an extra 8s, which added to the increase of 6s. per ton meant 14s. If the condition had been insisted on, consumers would have had the price of gas raised by another 1s.·6d., or to 5s. 9d.! Even Manchester had to take coal from Durham by sea; and it cost the undertaking for the part of their requirements that they had to so take 53s. per ton, against 37s. 3d. had the same coal been sent by rail. A little relief, it is understood, has been obtained in exceptionally hard cases. But as lately as Nov. 11, the members of the Central Executive Board of the National Gas Council stated that a letter from the Prime Minister had been received in which it was said that he could add nothing to the letter addressed to the Council by the Minister of Shipping on Sept. 23, in which it was stated that it was impossible at the present time to consider the question of a reduction of freights. The resolve to continue to press this matter is not dead.

Leading up to the Coal Commission.

Coal and its cost have such a large bearing upon the fortunes of the gas industry that by all gas men the momentous events of the year connected with coal have been followed very closely. Let us therefore run lightly over the matters that led up to the Coal Commission. At the beginning of the year, the South Wales Miners' Executive proposed that the Eight Hours Act should be modified to six hours; the idea being that this would absorb incoming labour due to the termination of the war. Prior to this, as stated in the "Retrospect" for 1918, the Miners' Federation had asked for a six-hour day, payment for afternoon and night shifts at the rate of six shifts for five actually worked, retention of the war rates of wages, and the merging of the percentage bonus into wages, and other things. Then in the middle of January, there was a demand for a minimum advance of 30 p.ct. on the present wages; the districts varying in their proposals up to 100 p.ct. The 30 p.ct. was to be accompanied by a six-hour day. The miners' mouths had opened very widely by this time; and they remained open. Yet another proposal was the payment of the full trade-union rate of wages to all returned soldiers who failed to obtain employment, and to all civilian workers displaced by demobilized soldiers. Not a few men would have used their wits to have remained unemployed on these terms, and not a few would gladly have parted with their work to demobilized soldiers. The nationalization of mines was a further claim. It was estimated that the 30 p.ct. increase would represent 4s. per ton on coal, or between 30 and 40 millions sterling per annum. Then there was objection on the part of the miners to the men who had drifted from other industries to the mines during the war being sent away to make room for demobilized miners. This, of course, was a piece of strategy in connection with the six-hour day business. The Government made an offer (the terms of which need not be repeated now), including a suggestion for a Committee of Investigation, which was rejected by the miners. The position then became critical; and, as usual, there were threats of a strike. There was a lot of sentimental talk from the leaders as to raising the standard of the miners' life; and it may be construed from this that no part of the higher rates of pay already being received was being devoted by the men themselves to so laudable an object. A ballot of the men was taken; and strike notices were handed in.

The Coal Commission.

Then—this towards the end of February—came the offer from the Government of the appointment of a Royal Commission to make inquiry into the claims; and a Bill constituting it was passed through the Houses in three days. On this Commission the miners were offered fair representation, which was accepted. The Hon. Mr. Justice Sankey was appointed Chairman; and among the members was Sir Arthur Duckham. Mr. Robert Smillie, the President of the Miners' Federation, was also a member. The first part of the inquiry was directed to wages and hours; the other matters being left for a second stage. A great mass of evidence was taken—one of the principal witnesses being Mr. A. L. Dickinson, a member of a well-known firm of chartered accountants. One point from his evidence was that, based upon the available data, he estimated that the reduc-

tion of the hours to six would mean a decrease by 20 p.ct. in output; and to compensate for the lessened output an increased cost would be incurred of 2s. 7d. per ton. This was based on the figures for September, 1918. The desired increase in wages would represent an additional 4s.—making an increase of 6s. 7d. per ton. Mr. D. Milne Watson gave evidence on behalf of the gas industry.

The first or interim report was issued within the time promised. But "report" is hardly correct; for there were three—one signed by Mr. Justice Sankey and three of the Commissioners (including Sir Arthur Duckham), one by the coal representatives, and one by the representatives of the miners, who were supported by Mr. Sidney Webb and Sir Leo Chiozza Money. The report proposed that the miners should have a voice in the control of the industry in respect of matters in which they are concerned; that 1d. per ton should be set aside for providing better housing accommodation and working conditions; that the coalowners' profits should be limited to 1s. 2d. per ton; that a seven-hour day for underground men should be conceded from July 16, and a reduction to six hours from July 13, 1921, subject to the economic conditions at the end of 1920 allowing it; while surface men were to have a 46½-hour week from July 16. As to wages, the colliers were given an increase of 2s. per day, and boys 1s. Although the cost of these concessions was estimated at an enormous sum, the Government accepted the report. The Miners' Federation Executive put forward several amendments; but the Government would not budge from the report. Thereupon a ballot of the miners was taken—the Miners' Executive, seeing the Government were resolute, recommending the men to accept the report. The ballot resulted in 693,084 in favour of acceptance, and only 76,992 in favour of rejection. So we came to the close of the first chapter of events which have made such a profound depression in the national fortunes of the country.

The Six Shillings Increase.

But there is a sequel. In the Sankey report, by a course of reasoning which was not justified at the time, the country was asked to believe the concessions made to the miners could be fully met without having recourse to raising the price of coal. Before long in the House there were heard computations which warned the country that it would soon have to face an increase in the price of coal to meet the new commitments. The predictions rose in degree; and then the real shock came on July 9, when it was heard that to the already high price of coal there would have to be added 6s. per ton, owing to the reduction of the working hours of the miners and the diminished output per man; and this before the effect of the shorter hours was seen. What the new impost meant directly in money for the country—without considering the value that would be lost through its effects—was, to put it briefly, on the basis of a year, as follows: On the 161 million tons consumed for home purposes (deducting the coal used at the collieries, that supplied for miners' use, and that exported, as well as bunkers), the 6s. per ton totalled to £48,300,000—the actual deficiency being £46,600,000, or equal to 5s. 9½d. per ton. Of this sum, the gas industry had to pay at the rate of 6 millions sterling per annum. The Order issued by the Board of Trade increased the price of coal to 6s. per ton as from July 16—the day that the seven-hour working period for colliers came into operation. It was shown by a statement issued about the same time that of the total costs of working, the item of labour would as from July 16 account for 21s. 10¾d. per ton, compared with 6s. 4d. in 1913. The coal miners protested that the 6s. increase was not warranted.

A Speculative Reduction of Ten Shillings.

With this heavy burden of coal the country struggled all through the remainder of the summer, the autumn, and the beginning of winter until Dec. 1. Such stocks as could be accumulated for winter use were of an attenuated order as compared with what were formerly considered normal for the time; and they were at the high price. There were strikes in the coalfields, there was the national railway strike, there were the heavy freights for seaborne coal, production of coal fell-off seriously from the day the seven hours came into operation, though in the autumn the miners showed more energy and pulled-up again. In November, the President of the Board of Trade hinted at the possibility of a reduction in the price of coal, although even then he stated that inland coal was being sold at a loss. Within a fortnight the country was startled by an announcement in the House that coal would be reduced by 10s. per ton for that part used for domestic purposes, that coke would also be lowered in price, but neither of them for industry, and that coal would also be reduced in price for gas and electricity produced for domestic purposes, but not for industrial. The enabling causes were stated to be the world's shortness of coal, to which the American coal strike contributed. The result of this shortness was that the profits on export coal from this country provided a source from which compensation could be derived for the loss on coal used inland. The other cause was the improved production of coal. Both these causes are highly speculative; and the financial one has not economic robustness. The President of the Board of Trade said he hoped this would do something towards checking the revolution in the "vicious circle" of rising wages and increased prices, which made the cost of living so high. Naturally the miners were delighted—Mr. Smillie particularly so, as they claimed this was a justification of the attitude taken up at the time the 6s. per ton rise was made. No credit was given by them to changed circumstances. A strong protest was made by Colonel Le Roy Lewis, at the meeting of the Continental Union Gas Company, against our suffering allies being charged an excessive price for badly-needed coal in order to help to compensate for coal being sold at a loss in this country.

Immediately the announcement was made as to the reduction applying to gas coal, the newspapers and some politicians spoke of the price of gas being reduced simultaneously with that of coal. The impracticability did not strike them. When the price of coal had been increased, it had only been possible for the gas undertakings to advance the price of gas at the end of the quarter; and so the end of the quarter was the time when any reduction that was possible in the price of gas could come into force on this occasion. The public, too, were given to understand that the price of gas would be reduced by 10d. in view of the 10s. reduction in the price of coal. But the public and the short-sighted prophets did not take into account various factors that governed the situation. The price of coke was to be reduced for domestic purposes, which would account for some part of the 10s. by which the price of coal was to be lowered; there were the stocks of coal accumulated at high prices for winter use, on which the difference in price would have to be liquidated in some way; there was the burden of seaborne coal at high rates of freight; there was the claim waiting to be adjudicated upon for still higher wages for gas workers of 10s. a week for adults and 5s. for juniors; and there was the prospect of higher railway rates. The proportion of water-gas manufacture is also a disturbing condition in making calculation. The factors that were certain put the reduction of 10d. wholly out of the field. In these matters the public and the Press are slow of understanding.

Question of the Nationalization of Coal Mines.

The miners having accepted the Sankey interim report on hours and wages, the way was paved for the opening of the second part of the inquiry by the Coal Commission. This was to deal with the claim of the miners that the coal mines should all be nationalized. The case of the miners' leaders had been well promulgated—Mr. Smillie had taken good care of that. Coal was a national asset, and should be worked by the nation and by the nation's money. The capitalist owners only worked for their own profit, and did not work the coal in the best of ways to secure large productions. All the virtues were on the side of the miners; but the conditions of their lives were deplorable, and their housing accommodation a disgrace. The fact that miners come from a stock that has for generations worked in the mines, and has found the life sufficiently attractive not to migrate to other callings, was brushed aside. A cool and disinterested examination of the case put forward made it a matter of surprise, if all were true as presented, that there were men to be found who were willing to work in the mines at all. But the fight was severe for nationalization by the leaders of the Miners' Federation, and not by the rank-and-file; and everything pointed to the fact that there was much padding about the case, and that the objective was not nationalization, but control of the coal mines by the Miners' Federation. In short, the end is Syndicalism. The

nationalization of the mines, did the Government give way, would simply be the thin end of the wedge to nationalization of industry generally, and something more.

In the first report of the Coal Commission, there was an indication that Mr. Justice Sankey and those who signed the document had arrived at the conclusion from what they had already heard that, in the interests of the country, there should be a large reorganization of the coal industry, and control of a fresh order. In the course of the first inquiry, Sir Richard Redmayne had said he was persuaded that the present system of individual ownership of collieries was extravagant and wasteful, and that a considerable part of the expenses borne by the country was due to the complicated distribution machinery which exists, and which, at every fresh break in the line of direct supply, meant added profit for someone. Sir Richard appeared to be rather in favour of collective working. So the evidence before the Commission was, in effect, between nationalization and re-organization and control. It was a big battle—a battle between brains and a handful of stubborn theorists. Men of great capacity and discrimination, and men of considerable business experience, were totally against nationalization. The miners' representatives, supported by visionaries prepossessed by nationalization doctrines, dogmatized on their side with great vehemence. It was a curious spectacle to see men sitting in the seat of judgment with minds already made up; it was a still more curious thing to see members of the Commission who were there to pass judgment on the evidence placed before them entering the witness-box in support of nationalization. A bigger farce a Government never sanctioned. For the gas industry, Mr. Milne Watson, Mr. William Cash, and Mr. A. E. Broadberry gave evidence (need it be said?) against nationalization; and Mr. Cash advocated the application of the principles of co-partnership to the coal industry.

The result of the inquiry was the issue of four reports. One was by Mr. Justice Sankey, who found himself clapped on the back, and heartily supported except in one or two details, by Mr. Smillie and the other miners' representatives and Mr. Sidney Webb and Sir Leo Chiozza Money. The report was in favour of nationalization; and Mr. Justice Sankey expressed his belief that, with the State as owners, there was fair reason to expect that the relationship between labour and the community would be an improvement upon the relationship between labour and capital in the coalfields. This opinion was to receive a rude shock at an early date. Altogether it was a most illogical report; for it was clear that the Chairman himself anticipated trouble when he suggested that to cease work should be made impossible till questions of dispute had been before a district mining council, and then, should this fail, before the National Mining Council—these being bodies that were part of his scheme. It was in part against any attempt to undermine the power to strike that the miners' representatives made a short protesting report of their own, while subscribing to the main conclusions in the Sankey document. The coal industry's representatives on the Commission had no objection to the State acquisition of coal, but not of the mines; and they were prepared to do more in giving the men a voice in respect of the part of the management that related to working conditions. But the report that attracted much attention was the independent one of Sir Arthur Duckham. It was very generally regarded as the most constructive of all. He was dead-against nationalization of the mining industry. It would, in his opinion, be an unprecedented and a colossal experiment; and a mistake would result in national calamity. He was in favour of the nationalization of coal, a division of the coalfields into areas, and a re-organization and consolidation of working; and the miners would have a specified share in management, as well as the application of a scheme of co-partnership. More effective control, too, would be given by the establishment of a Ministry of Mines, with District Coal Boards. His object obviously was to secure conditions which would harmoniously promote the triple interests of consumers, workers, and colliery owners.

Then ebullition started again. The miners' representatives, or some of them, began to talk of what would be done if the "majority" report was not adopted; the majority report obtaining title to that name by the signatures of the mining element on the Commission and of Messrs. Webb and Money. We began to hear of possible strikes, and of "direct action" on political matters, with the view doubtless of bringing pressure to bear on the Government. The Press had much to say on the matter; questions were asked in the House, and obtained evasive answers. Men of large industrial and financial experience condemned the Sankey report as being an attack on private enterprise and individual effort, and as proposing to introduce something that would be the initial stage in overthrowing the stability of all that had made this country what it is. The Government, however, were not to be coerced by union threats. The question was a national one, and was not to be settled at the command of a section of the community, and that an interested one. They saw, too, in the threats of "direct action" on political subjects a menace to democratic Government, and to the exercise of the free will of the people. It was also a menace to the supremacy of the Government itself. It was clear the public were beginning to resent the dictation of trade union extremists; and they were showing a determination to uphold the Government against this dictatorial attitude of the trade unions, although not under-estimating the strength of what is known as the Triple Alliance—*i.e.*, the Miners' Federation with its 700,000 or so members, the National Union of Railwaymen with its 400,000 or so members, and the Transport Workers' Federation with some 300,000 members. But the State is stronger than all the trade unions put together. Sensible labour leaders saw the danger, and counselled moderation.

THE DECISION OF THE GOVERNMENT.

Then came the decision of the Government. Reason had predominated. They announced their determination not to nationalize the coal mines; but to make a State purchase of the mineral rights—a deduction to be made from the purchase value to create a fund for the social improvement of the conditions of the industry. Another feature was the division of the country into mining areas; and the grouping of the areas under the control of a body upon which labour would be represented. Conditions to be approved by the Government would be applied for protecting the consumer; and there was some indication that this would take the form of a profit-sharing plan, based on the price of coal to the consumer. It was clear that this would not go far enough for the powers controlling the Miners' Federation. There was a revival of the talk of force; while others spoke of adopting the more rational plan of a campaign by propaganda to convert public opinion in favour of the nationalization of the mines. The matter came up at the Trade Union Congress in Glasgow. At the instance of Mr. Smillie, the Congress rejected the alternative scheme of the Government, and resolved to co-operate with the Miners' Federation to "compel" the Government to adopt national ownership. It was decided that the Prime Minister should be interviewed; and at the interview the Parliamentary Committee of the Trade Union Congress and the representatives of the Miners' Federation were to "insist" upon the Government adopting the "majority" report of the Coal Commission. Then, if there was no satisfaction, a Special Congress was to be held to consider what steps should be taken to "compel" the Government. The interview with Mr. Lloyd George was held; but he would not shift by a single step from the decision of the Government. He confirmed this in his speech in the House in August, when dealing with trade and industrial problems. The Special Trade Union Congress has been held; and it has been decided to postpone further action in regard to the decision to compel the Government till the reassembling of Parliament in February. The campaign by propaganda is to proceed.

In his report Mr. Justice Sankey expressed the pious belief that, if the coal-mining industry was removed from private enterprise to control by the community, the men would work better. Subsequently the futility of such belief was shown by the great Yorkshire coal strike, and (in sympathy) the sporadic strikes in other coal areas. There was also the attempt in South Wales to force a strike over the question of the payment of income-tax by the miners. All this while the mines were under the control of the Government. Then Mr. Duncan Graham, M.P., at a conference of Scottish Mine Workers in August, said: "If the mines become the property of the nation, the miners would have to be more determined in their policy, and more vigorous in their trade union organization, because instead of fighting the local employers, they would be fighting the Government." This does not promise well for peace if the mines were transferred to the nation. The railways, too, are under Government control; and the National Union of Railwaymen are seeking their nationalization. Government

control notwithstanding, the country experienced in the autumn a nine days' national strike on the railways, which fortunately did not end to the credit of the Union.

COAL SUPPLIES AND STOCKS.

Through the various influences that were at work during the year, coal supplies continued erratic and short, though there was an attempt on the part of the Coal Control Department to look as well as possible after public utility supplies—gas-works among the number. But many gas-works suffered, and that severely. In reducing production and supplies, the coal strikes and the railway strike contributed. Absenteeism continued to be a factor; and the production by the men remained low. They were charged with these things; their leaders blamed the owners and the conditions produced by the war. These no doubt had an effect, but not sufficient for the collapse of production after July 16, on which date the seven-hour day came into operation. And the fact that the miners themselves were primarily responsible was proved by the rapid move up that was given to production when the leaders saw that the community generally was getting tired of the miners' "control" of the first essential to the life—domestic and industrial—of the country; and they saw that their own acts were hardening public opinion against their cherished hopes and ideals. Increased production, too, may have been in part due to the new light that was being shed on the fact that the country was drifting, through the action of the unions in depressing production of all kinds, into a state of things the effects of which would be felt most acutely by the working class. The fall that took place in coal production cannot be attributed to shortness of men. The Premier, in his "Industrial and Trade Problem" speech in August, stated that in 1914 1,110,000 men were engaged in coal mining; while at the time he was speaking, 1,141,000 men were engaged. A year's production of coal before the war was 287 million tons; at the then rate of output, there would be produced about 200 million tons. In 1913, the average price of a ton of coal at the pithead was approximately 10s.; on July 16 this year, it was 26s. To this price and short supplies, much of the country's dismal position is attributable.

At the beginning of the year supplies to gas-works were going from bad to worse; and many were living almost from hand to mouth. The severe weather and the dislocation of the railway services were then causes for the conditions. With the lengthening days and warmer weather, the position eased a bit; but the outlook for stocks continued gloomy. To the meeting of the Institution in June the then Coal Controller (Sir Evan Jones) sent a letter, in which he said that stocks were improving. There was an average of three weeks' stocks in the greater London works; and an average of two-and-a-half weeks' stocks in provincial works. Some works were apparently very fortunate; for there were others with less than half a week in stock. Even at the beginning of December, some imposing works could not boast of more than a fortnight's supply; while others were well stocked. In July came the seven-hour day; and week by week production dropped. But later it showed some recovery, as the following record (which it will be interesting to preserve) shows:

	Tons.		Tons.
May 31 . . .	4,812,595	Sept. 6 . . .	4,509,863
June 7 . . .	4,614,034	Sept. 13 . . .	4,489,816
June 14 . . .	3,256,508	Sept. 20 . . .	4,450,308
June 21 . . .	4,736,841	Sept. 27 . . .	4,481,434
June 28 . . .	4,806,933	Oct. 4 . . .	2,871,610
July 5 . . .	4,728,588	Oct. 11 . . .	4,076,862
July 12 . . .	4,796,148	Oct. 18 . . .	4,727,465
July 19 . . .	3,893,651	Oct. 25 . . .	4,761,037
July 26 . . .	2,537,954	Nov. 1 . . .	4,674,532
Aug. 2 . . .	3,614,776	Nov. 8 . . .	4,804,456
Aug. 9 . . .	2,642,895	Nov. 15 . . .	4,679,402
Aug. 16 . . .	3,726,499	Nov. 22 . . .	4,767,578
Aug. 23 . . .	3,989,762	Nov. 29 . . .	4,762,729
Aug. 30 . . .	4,354,983	Dec. 6 . . .	4,808,524

Stoppages of work in the coal mines and the nine days' railway strike, of course, had a lamentable effect on output. In January there was a stoppage of 150,000 miners in Yorkshire over the question of a twenty-minute dead-stop for refreshments by surface workers; but this was settled by the concession of the demand by the Coal Controller. Then came the great Yorkshire strike in July, in which some of the miners in Derbyshire, Nottinghamshire, Lancashire, and Cheshire joined with the men from a few pits in Durham. Some of the men ceased work as a protest against the 6s. per ton increase; but the greater number were out in Yorkshire in connection with some little difference as to the percentages of piecework rates which they required to compensate them for working fewer hours. Terms for piecework had been arranged between Government representatives and the Miners' Federation; but this did not satisfy the Yorkshire District Union. The tale is, however, too long to relate here; but it may be said that the difference was infinitesimal. The whole thing was very silly. The men in South Yorkshire area were out for three weeks; the men in West Yorkshire rather longer. Many of the men themselves were utterly sick of the business; but out of loyalty to their Union—not to the country—they remained idle until their leaders had to pocket their dignity and give way. But the damage to the country was incalculable; and the people in other industries who were rendered workless through lack of coal made progressively an immense number. Their feelings were not the most friendly towards the miners. However, the miners were severely punished by loss of wages; and the funds of the District Union reached almost the vanishing point. The last week's strike pay was only 9s. per man, and 1s. for each child. Without the loss of wages to the men, about £375,000 was paid out of the funds of the Union; and loss of interest and income from the subscriptions of the men on strike, it is calculated, made the total loss to the Union about £450,000. It was a miserable business. Yorkshire contributes about 17 p.ct. to the total coal output of the country. It is reckoned that this strike alone cost the country a loss of production of about 5 million tons. Mr. Hartshorn stated in the House on Nov. 28 that the loss of output through strikes (including the railway strike) during the year amounted to approximately 8 million tons.

A great deal more could be said on this subject; but time and space forbid. Just a few words on coal exports. The conditions at home did not help the export business; but it acted as a deterrent to expansion. Up to the November returns, the total quantity of coal exported during the eleven months amounted to 32,315,713 tons, compared with 29,660,615 tons in the same period of 1918. Of the quantity of coal exported during the past eleven months 3,017,886 tons was gas coal. The Coal Exports Committee was dissolved as from Saturday, March 8; and arrangements were made for merging the duties of the Committee with those of the Coal Controller.

THE COAL-OWNERS' PORTION.

Nobody in the coal industry appeared to derive satisfaction from the proceedings of the Government in connection with coal. In the Sankey report, it was proposed that there should be limitation of the coal-owners' profits to 1s. 2d. per ton, which, it is stated, is 2d. more than the average before the war. When it was found that the Government intended to give effect to this proposal, there was a great protesting outcry from all the owning quarters. It must be admitted that the proposal does not show any great sense of justice, nor has it any intelligent business basis. In the first place, the capital required per ton of coal varies as between different pits; and, in the second place, the quantity of coal raised now is subject to circumstances over which the coal-owners have no control. Therefore the 1s. 2d. gives no assurance to them of securing their pre-war profit. Moreover, the purchasing power of money is only about one-half—perhaps rather less than one-half—what it was before the war; and income-tax is an infliction that makes serious inroads upon incomes. Those who have put money into the coal industry have in this matter fair ground for complaint. Where there is no objection to the limitation of profits, it is an unsound proposal to shift them from a percentage on the capital employed to a fixed sum per ton. But limitation should also be subject to a sliding-scale, based on the price to the consumer, in order to encourage good management. The Government introduced a Bill—the Coal Industry (Emergency) Bill—to carry through the proposed limitation; but there was much opposition to it on various grounds from all quarters of the House—on general principles and on details—and the Government therefore withdrew the Bill for reconsideration. The grounds of opposition were referred to in our issue for Dec. 16. The day following the Bill was withdrawn by the Government, who saw there was no chance of obtaining its acceptance. Then yesterday week Sir Auckland Geddes gave an indication of the new coal

policy of the Government. The Bill has been dropped. The Miners' Federation having intimated that the measure did not in their opinion carry out the pledge the Government had made, and that they preferred the continuance of the Coal Mines Control agreement, the Government had had to consider what this would mean to the coalowners and the general taxpayer if the agreement were adhered to. From both points of view, adhesion would work such injustice as to be impossible. From the public point of view, it would involve a loss to the Treasury. The readjustment of the finances of the industry is imperative; and the position is now being explored with the object of arriving at a fair and equitable distribution of the total profits.

CONCLUSIONS FROM THE YEAR'S COAL MOVEMENTS.

Coal is at the very foundation of the gas industry's prosperity; and thus, the movements of the year having been so many and so momentous, their review, though in very concentrated form, has run to some length. This review shows us three things: (1) The causes that have operated to make the coal position during the year so changeful, difficult, and harassing; (2) the transformation of the coal industry's conditions from the pre-war state to entirely new ones; and (3) that there is no ground for the slightest hope that the cost of coal per ton at the pithead will sink permanently by any considerable amount from current figures. As a matter of fact, it is admitted that inland coal is being sold at a loss, and that this is counterbalanced by profits made from coal delivered to other countries. This sort of thing cannot continue long. Reaction is bound to come.

OIL SUPPLIES.

While the subject of coal is before us, it may be said that the position in regard to gas-oil improved considerably during the year, though not to the extent that would have been highly appreciated by the gas industry. But, like coal, it is not anticipated that we shall get back again to the old times—at any rate in respect of cost; but there will be some compensation in the fact that the industry has learnt to accommodate its working to a lower consumption of oil per 1000 c.ft., and to none at all, other than at times of extreme pressure, or for the purpose of lubricating the mains and meters, to neutralize the effects of gas from which benzol is extracted. At the end of January the Petroleum Supplies Pool Board was dissolved; and freedom was thus given to buyers to go direct to suppliers to satisfy requirements. A nine months' period was, however, allowed for the petroleum companies to reinstate their organizations, which had been disturbed as a result of the Pool Board's operations and the exigencies of the war. This interval finished on Oct. 31; and all control of supplies and distribution ceased. In February the Pool Board made an order fixing the price in bulk *ex* wharf at 8½d. per gallon; and though the National Gas Council made an application for a further reduction, the 8½d. continued until December, when it went up to 11½d. In the first six months of the year the imports of gas-oil were considerably lower than during the corresponding periods of 1917 and 1918—being only 10,078,966 gallons. In the eleven months to November, the imports of gas-oil amounted to 25,804,319 gallons, compared with 35,476,660 gallons in the corresponding period of 1918, and 29,082,120 gallons in the same period of 1917.

There has been a large amount of interest during the year regarding the work instituted by the Government in exploring the country to ascertain the possibility of tapping subterranean sources of oil supply. Though one or two of the borings were highly encouraging at first, there have been unavoidable difficulties and accidents; and there are doubts now as to the wells becoming paying propositions. Asked in the House only the other week as to whether the prospects were so good as they were supposed to be a few months ago, Mr. Kellaway said: "I should like to reflect on that before giving an answer." This does not look promising. However, the "Petroleum Times" states that it hears from an authoritative source that a Bill has been drafted which will place matters upon a more satisfactory basis in regard to home oil supplies. Companies have been formed to develop oil production from the shales of this country—particularly the Norfolk.

A REMARKABLE LABOUR HISTORY.

The rejoicings over the signing of the Armistice had hardly ceased when it was seen that the trade unions—those with extremist leaders at their heads—were going to set the pace for the framing of new conditions for labour. One way of doing this was by getting war wages stabilized and perpetuated, and even additions made to them; another was by establishing shorter hours of working. This led to a general labour upheaval throughout the industries. The lead was taken up vigorously; and there was a perfect riot of excessive claim. The Government are much to blame for this, through the loose way in which labour was dealt with, and payment made for labour engaged on war work. Claims were conceded for the sake of industrial peace, with the idea that at the end of the war things would gradually right themselves. They have not, and will not; and so we are reaping the harvest in this regard of impolitic government. We have seen what has happened in the coal industry. The year had not far advanced before men in the shipbuilding and engineering trades were asking that the 47-hour week which had been agreed upon should be reduced to 44; and in some cases the claim was for 40 hours. There were strikes in Belfast, Glasgow, and London in connection with the engineering and shipbuilding industries; and then in the forepart of the year (this apart from the national one in the autumn) came a partial railway strike, which among the inconveniences checked coal deliveries. The strikes in the early months of the year were mostly unauthorized by the unions; and the Government declined to interfere. The strike at Belfast extended to the municipal works; and the gas and electricity supplies were affected. A few gas undertakings had short strikes—mostly to do with wages and hours. A strike that has affected all engineering industries—the gas industry among them—is that long drawn-out one of the foundrymen and moulders. The amount of unemployment that this has caused has been considerable.

But the greatest strike of all was that of the railwaymen to compel the Government to standardize the wages of all grades of workers on the same principles as had been applied to the case of the locomotive men. The strike failed of its object; and trade unionism had one of the sharpes reminders it has ever had that the public are not to be cowed or forced, nor will they allow democratic government to be destroyed or defeated or violated by the actions of any one section of trade unionists. Trade unionism has developed in power and in methods—not always so righteous as they might be; but trade unionism through the railway strike has learnt that the rest of the world has not been standing still, but has been making progress, and that its resisting power to arrogant demands is greater than it ever was. Transport facilities are not confined to the railways, nor driving skill and manual strength to trade unionists. And so the country put up with inconvenience, and dispensed with the services of the railwaymen so long as these felt desirous of withholding them, and compelling themselves and their families to live on strike pay with the cost of living what it is, and which high cost has been largely brought about by the excessive rates of pay for labour. The two things are inseparable; but many of the workers think they ought to have excessive pay, and that ways and means should be found for bringing down costs of living. One way of doing this would be by increased production per man; but with higher wages have gone shorter hours. Increased production it seems must come from other methods than manual; and for many purposes higher wages and shorter hours have so driven up the capital cost of manual labour that it is now far cheaper to spend money upon mechanical operation. The writings and letters of certain labour leaders who look beyond the present, and have the intelligence to fit things into their proper places, and are able to see their interdependence, have warned the labour world that a dangerous road is being trodden, and that all is not well. That this is having some good effect was seen two or three weeks since, when a crisis was threatened in the engineering industry over the question of the 44-hour week. At a meeting of representatives of the men, a decision was come to in favour of a Joint Committee of Inquiry, to consider the economic effect of the proposed reduction of hours.

At the same time, we have the Government introducing two revolutionary Bills, which provide for the State regulation of hours and wages of labour, and so limit for good in these respects the operation of economic laws. One of these Bills provides for the working week not exceeding 48 hours in (with few exceptions) all industries; and the payment for overtime is not to be less than 25 p.ct. The other is to secure a living wage for all persons of fifteen

years of age and upwards; the rates to be fixed after inquiry into the whole subject of wages. These two Bills were one of the outcomes of the National Industrial Conference last February, when the scheme was also put forward for the establishment of a National Industrial Council, upon which gas employers are represented by the President of the National Gas Council (Mr. D. Milne Watson). The International Labour Congress at Washington also adopted the 48-hour week, with the reservation that the resolution was not to interfere with any better conditions already in operation or that might be agreed upon. There are many of the employed classes who use their brains and see that all this limiting of their labour is removing from them the exercise of their free will, and reducing the market for their skill or working power. There have been many schemes put forward for trying to improve the relations between industry and labour; and something will soon have to be done to improve the relations of labour to the rest of the community. Among the plans that the Government have been responsible for are the National Industrial Council, the Whitley schemes, and the measure passed for establishing Industrial Courts (members of the central tribunal have already been appointed) for the settlement of disputes by arbitration. There was mediation between representatives of Trade Unions and the Government in connection with the railway strike; and this was regarded as having been so satisfactory that a proposal is being developed to form a permanent Trade Union Council representative of the organized labour movement to advise, and possibly intervene, in disputes with the view to the prevention or settlement of strikes. In connection with railway hours and wages, the Government are proposing to set up special machinery.

A good deal more attention is being given to co-partnership; but there is strange hesitancy to adopt it. Employers and some of the trade unions look at it as something to be avoided, instead of seeing in it the ground on which mutual interest and goodwill will grow, in place of mutual distrust on other ground. Recently we have seen that the National Association of Carpenters and Joiners passed a resolution excluding from membership any employees of Messrs. Lever Bros. who were benefiting under the co-partnership scheme. Yet Mr. Henry Gosling, one of the unionist mediators in the railway strike, has said that the real substance of the demand of labour is that they shall be raised from the status of employees to the status of partners. Lord Robert Cecil believes this is true; and the Premier has made a powerful appeal to labour to reconsider the problem of profit-sharing. Meanwhile profit-sharing continues to influence affairs in the gas industry, though bonuses have disappeared where a minimum has not been established, or a bonus equal to the rate of dividend is paid. In the gas industry a striking development in connection with co-partnership has been Works Committees, which are doing excellently. A Bill is about to be introduced in order to extend unemployment insurance to other trades.

In every direction we are moving on to more democratic lines. It has been seen that the Government are proposing to give the miners effective representation in their scheme of mine control; and following upon this the Government have made the proposal, and the Executive of the National Union of Railwaymen have approved, that three railway workers—two representatives of the National Union, and one of the Amalgamated Society of Locomotive Engineers and Firemen, shall serve on the Advisory Committee of the Ministry of Transport. This Committee has already been appointed; and other machinery has been set up (in which the two Unions have representation) to deal with wages and conditions of service. The conditions will prevent lightning strikes on the railway—in fact any strikes—until the newly established resources for settlement have been exhausted.

Labour within the Gas Industry.

The gas industry has, through greatly increased costs, suffered more from the movements in the outside labour world than within their own particular section of it. But a movement that was so universal for enhanced conditions was bound to penetrate even an industry the labour in which is so well looked after; and the Federation of General Workers were soon going with the tide. Fortunately, in these discussions, the industry has new conditions, in that it has now what formerly came into being as the Committee of Employers for the Gas Industry, and is now known as the Federation of Gas Employers, who can speak in terms of authority for the whole gas industry. A Joint Industrial Council for the industry has also been formed, on which are represented both municipal and company undertakings and the unions with gas employees in their membership.

The review of the question of gas workers' wages was due in February; and an application was made for an increase of 10s. per week to all men above 18 years of age, and 5s. to juniors, both on time rates, with a 44-hour week. The matter went to arbitration, and the award was just half of the amount claimed—the increase coming into operation on Feb. 1. For adults this meant wages above pre-war rates of £1 8s. 6d., *plus* the 12½ p.ct. The discussion over the 44-hour week went on for some time; and eventually an agreement was arrived at. This reduced the hours of the workers other than shift men to 47 per week; while shift workers on eight-hour shifts were to have their rate of pay per shift increased by 6d. Twelve-hour shifts were to be reduced to eight hours on the understanding that the same amount of work was done in the eight hours as during the twelve. Now a fresh claim is under consideration. It is for a further increase of 10s. for adults and 5s. for juniors. But the Federation of Gas Employers have stated that this claim cannot be entertained—in fact, the Manchester District Federation of Gas Employers have recommended the Central Committee of the Federation to prefer a claim for a reduction of the war advances made to gas workers. It is expected that this claim will soon come before the arbitrators. But already wage payments have gone up to most remarkable heights. In the first half of the year the total expenditure on wages in the South Metropolitan Company was £692,896, or an increase of £181,727 on the corresponding period of 1918!

At the beginning of the year, the shortness of labour in the industry and the demobilization of gas-workers were matters of frequent discussion. The pace of return was very slow; and the National Gas Council moved in the matter. Later, the men were returning more rapidly; and the question has had a natural death. There were several well-deserved references to the excellent part women had taken in filling in the work of the industry the places of men on active service. A special appeal was made by the King to employers generally to give suitable employment to disabled men: but the gas industry, through the very nature of its work, does not give it much scope. All gas undertakings, we are sure, are doing what they can; but most of them have their own disabled to look after.

Steps to Financial Revision.

It will have been observed that in this review we have so far been dealing with the two main questions that have had such a disastrous effect upon the financial fortunes of the gas industry. But, of course, there are others. Through the general rise of expenditure in all industries, there has been an advance of considerable magnitude in the prices of the required materials and manufactured goods ranging from 100 to 500 p.ct. This means a heavy burden upon capital, both of the permanent and floating orders, as well as on working expenditure and costs of repairs, maintenance, and renewals. More money is now required for a given amount of business. But under statutory conditions (peculiar so far as the sliding-scale is concerned to the gas industry) as to standard prices and dividend and maximum prices and dividend, dividends have declined to the meagre point at which the Statutory Undertakings (Temporary Increase of Charges) Act comes into action; and so gas stocks and shares have depreciated enormously. Under the Act just mentioned, a large number of undertakings have had to take refuge during the year to save themselves from financial wrecking. It is, in these circumstances, difficult now to raise money for gas undertakings, except at high rates of interest for redeemable debenture or preference stocks. And there is a veritable scramble for capital by other industries to-day, with offers of high dividends and interest, since the embargo on capital issues has come to an end. Out of justice to the old investors who have suffered all too long, and in order to restore the credit of the industry, it was imperative that, the war being at an end, no further time should lapse without doing something to rehabilitate its finances. It has lately been seen that even old-established gas companies have had difficulty to place the full amounts offered of redeemable debenture stock carrying 6 p.ct. interest. The reorganized National Gas Council and its President have been persevering on the subject; and Dr. Carpenter, Mr. H. E. Jones, Mr. Charles Hunt,

and most of the leading men in the industry have, in public speech and otherwise, pegged away at the iniquitous financial conditions under which the industry is labouring, and the urgent need for restoring the faith of the public in the gas industry as a source of investment. The business of the industry continues strong, despite the resistance of high prices; but the only way in which the required restoration can come about is through the placing of the existing capital upon a sound and equitable basis, and by giving new investors the assurance that their capital will not be prejudiced by (as the old has been) froward circumstances in excess of the ordinary risks of trading.

It was abundantly clear during the year that the holders of gas stocks and shares were beginning to get somewhat irritated over the want of signs of serious efforts to re-establish their financial interests, while recognizing that the blame attached more to quarters outside than to the administrators of their own undertakings. The time had arrived—the war being over—when reconstruction had to be considered. A condition precedent to anything of real value being done is to restore the credit of the industry, and produce a fresh flow of capital into it. And future conditions will demand that financial strength shall be greater than sufficed before the war. No industry can be expected to progress when conditions in regard to capital are such that its offers of new issues are avoided. A little brightness began to break through the gloom; and hopes were revived as to something of real value being done. The gas industry, through representatives, appealed personally to the President of the Board of Trade; and Sir Auckland Geddes saw at once the financial degradation which statutory stringency and new conditions had, all unmerited, brought on the industry. He promised to consider the question as to what could be done. This was heartening; and so was the view expressed by Mr. Honoratus Lloyd, K.C., at the South Metropolitan meeting in the summer, that he thought the new House of Commons would be more amenable to reason than the old one.

We believe that justice (so long a stranger in this particular) is now again at our side. Sir Auckland Geddes has promised that the Board of Trade shall deal with this matter in connection with the Bill that is to be introduced to give effect to the Fuel Research Board's report (known as the "Beilby report" for brevity) as amended. The promise was considered at a private meeting of the gas industry convened by the National Gas Council, and held on Oct. 29. On that occasion confidence was shown in the Board of Trade by a resolution recommending gas undertakings not to complicate matters in the coming session by promoting Private Bills dealing with the subjects that would be incorporated in the Government measure. While, however, the agreed modifications of the Beilby report were known, there was doubt as to what would be the nature of the financial revision relating to prices and dividends. Possibly more because of this than anything else, the South Metropolitan, the Commercial, the South Suburban, the Wandsworth, the Brighton, and one or two other companies gave notice of their intention to apply for certain revision. The Commercial Bill has been dropped; the Wandsworth one has now in it a clause to apply any general legislation to the Company; and the Brighton Company, while asking for an increase in standard price, has also a clause which will enable the adoption of any General Act that may be passed. The President of the Board of Trade has no doubt seen that the Gaslight and Coke Company and the remainder of the gas industry have implicitly put their faith in him to bring about just conditions. In that great remainder is the Harrogate Gas Company, the Directors of which months ago had been discussing financial revision, including a minimum dividend. There is no doubt that in view of the General Bill, the privately promoted ones will be held-up, as the principles governing these matters must be in accord with the legislation promoted by the Board, and as determined by Parliament. Had the Board of Trade been in the position to have shown earlier the lines they were proposing to take, we have little doubt that the Private Bills of the companies referred to would have been somewhat shortened. What the South Metropolitan and South Suburban Companies are proposing was stated in the "JOURNAL" last week.

The lines that financial revision should take have been much discussed. Some have thought that one thing should be done; some another. A much-favoured view is that the pre-war dividend should, in view of the changed economic conditions, be made the standard dividend; some would also like a minimum dividend to be named so as to avoid such a depression of the credit of the industry as has been experienced during the war. Some again consider that dividends should be increased beyond the pre-war level, in view of the financial conditions (which have reduced the purchasing power of money at least one-half), the high rate of income-tax, and the fact that so much capital was issued at a premium. The old terms of dividend were not of an order to stand such an ascent of costs as has been experienced, and part of which will be permanent. Then there are those who consider (and we are with them) that the standard price should be subject to some variation at certain stages of coal price changes, though coal price is not the only factor that bears heavily upon the industry's increased costs. There is the cost of labour, which has shown no settlement in its growth. However, we must exercise a little more patience, with the hope that, when Parliament reassembles, we shall soon hear what are the proposals for the betterment of the industry's financial position, for to-day the industry has one constitutional weakness, which must be put right. And, in putting it right, there must be care that protective provision is made against the sliding-scale being rendered inoperative by any such proceeding on the part of the Government in reducing (as they have lately done) the price of coal for the making of domestic and not industrial gas. This is a matter that the President of the National Gas Council referred to at the recent annual meeting.

REVOLUTIONIZING REPORT BY THE FUEL RESEARCH BOARD.

Excepting for such considerations as the restriction of business through the Fuel and Lighting Order (the provisions of which so far as gas and electricity are concerned have been suspended), the reduction of lighting business by daylight saving in the summer, and the continued control of the home price of sulphate of ammonia, the matters—coal, labour, and capital conditions—already dealt with, with the consequences of two of them in producing tremendous increases of costs, are those which have dragged the industry into its present position. We are looking forward to relief in respect of financial conditions; and the industry has now to devote itself to realizing the utmost economy possible in the utilization of the raw material which it employs, with the view of manufacturing its staple commodity at as low a cost as possible, as well as, in the national interests, contributing to coal conservation. With plant, coal, and labour all expensive, the rational course is to get from coal as many B.Th.U. in the form of gas as is practicable, so as to make the plant, the capital spent on carbonizing, coal and coke handling, and distribution plant, the ton of coal, and the man more productive. This is one way of attacking higher costs, supplemented by perseverance in increasing business, which will also yield a certain amount of economy in reducing the ratio of several of the charges to the business done. Through the necessities of the war, there have been valuable lessons in the industry from the steaming of charges and the dilution of gas by blue water gas. A small proportion of the coke that would otherwise be for sale is used for this, but with good commercial effect, for a greater quantity of gas is put into the mains, capable of generating a larger number of heat units, per ton of costly coal handled by dearer labour. Another advantage is that oil is saved completely, or the quantity is much reduced; and this is another economy, which is very welcome with oil three or four times its old cost. There we have the index to greater things for the industry.

At one time, there was great resentment in the industry against the agitation set up by the railway companies and the local authorities in regard to inerts; but this action, it must be admitted, has had a wonderfully good constructive effect. The complaints were made primarily owing to the technical staffs of the railway companies having found out that gas was being supplied to railway stations by different gas undertakings containing largely varying percentages of incombustibles—in some cases, up to as much as a third of the gas supplied being incombustible. Complaints and representations to the Board of Trade resulted in the reference to the Board of Fuel Research to report and advise as to the standards and composition of gas. The result of the reference was that Sir George Beilby and his colleagues produced a report (published last April) of a character that, if their recommendations are endorsed by Parliament—and we see every reason why they should be—will have a revolutionizing effect upon the industry, and upon its legislation. It is an epoch-making document. It opens up a vista of

larger opportunities and more extended service. It breathes freedom with, of course, safeguarding obligations. It is the strongest condemnation that has ever been produced of committing such an industry as gas supply—working under a variety of conditions, with coal of widely differing quality, and with gas used for so many different purposes, and so largely for heating and power—to (as has been the wont of Parliament) an inflexible standardized servitude, which has been fatal to the attainment of the highest efficiency, and is altogether opposed to the spirit of progress. The report invites the Legislature to look facts fairly in the face, and refrain from manufacturing statutory ties to strangle progress. It means a new charter for the industry; and the industry must do its utmost to live up to it in its own interests, which are also the interests of the consumers and of the nation.

The report did not answer the question as to what standard of gas should be prescribed, nor what should be the composition of the gas. The Board, being composed of men well versed in fuel problems, knew that fixed standards and compositions are impossible with manufacturing material not of fixed chemical and physical properties, and in view of the need to conserve coal. The researches of the Gas Investigation Committee had shown that, so far as the inquiry had gone, thermal efficiency with the gas appliances tested—whether the gas was of high or low calorific power, whether it was a straight coal gas or a mixture of gases—was approximately the same. It is obvious it would be so when it is considered that, in view of a higher calorific gas requiring more air for combustion than a lower calorific gas, the B.Th.U. per volume of the gas-air mixture at the point of combustion are approximately the same, and that given proper air adjustment and the burners opened-out so as to pass more of the lower calorific quality of gas, gases down to a fairly low (low as we regard it) calorific value can be supplied without affecting efficiency, and the gas can be produced more economically than a higher grade one. What the Board of Fuel Research therefore proposed in their constructive report was that every gas undertaking should be allowed to declare its own calorific power (with authority to revise in the hands of the Board of Trade on a satisfactory case being presented), and that in future the charge made should be based upon the heat units supplied. Many people reconnoitred very curiously the latter suggestion. It was something strange, and not at all the kind of thing their grandfathers did. Other men saw that the two recommendations are strongly linked together. The liberty as to selecting one's own degree of calorific value would—we feel confident—never be endorsed by Parliament without the justification contained in the principle embedded in the proposal that only what was supplied should be charged for. The gas industry had been almost ultra-conservative, and disinclined to tread new paths. But a change, generally speaking, has come over the industry. It was a question of accepting both proposals, or going on in the old ways. And most men now see considerable inherent commercial value in the heat basis of charging. The more one looks at it, the more one sees in it.

The Board also suggested that the obligation should rest upon gas suppliers of readjusting consumers' appliances, with the changed conditions of gas supply. This again, though it costs money, will be very advantageous. It is a proved benefit in those cases where the system of inspection and adjustment is already carried out. The maintenance of efficiency means the maintenance of satisfaction. The Board in their report referred to blue water gas as an ideal and most manageable gaseous fuel, and saw through it prospects of developing a dual supply of gas for industrial purposes. It was likewise alluded to as being for all ordinary purposes a "natural diluent." There were other proposals in the report, however, which did not meet with the approval of the industry generally—other than in one place, and that the South Metropolitan Gas Company. The report suggested that the maximum inerts in the gas should be 12 p.ct., which figure would have practically killed the value of the proposed heat unit reformation for the majority of companies not making water gas, or who could not, under the present conditions of their plant, steam their charges. A clause in the report also urged the removal of not only the sulphur compounds but cyanogen compounds. And it proposed that there should be a pressure of not less than 2 in. "at the *exit* of the consumers' meters."

The Council of the Institution of Gas Engineers took up these matters, at the request of the National Gas Council, and reported upon them, in conjunction with the Gas Investigation Committee. In regard to inerts, their proposal was that the 12 p.ct. should be altered to 20 p.ct.; and that the minimum pressure should be 15-10ths. The other matters were also discussed. There were interviews with Sir George Beilby by the representative organizations. The sulphur and cyanogen suggestion was dropped; and there were indications that there might be relaxation in other respects, so that unanimity could be secured. To get to the end of the long discussions with the authorities, at the meetings of gas organizations, and in the Technical Press, it may at once be said that October brought a compromise. Preliminary to this, a letter was forwarded to the National Gas Council by Mr. Garnham Roper, of the Public Utilities and Harbour Department of the Board of Trade, announcing that the Board intended to introduce a Bill as early as possible into Parliament to give effect to the recommendations of the Beilby report, as well as a Bill to deal with the financial difficulties which had arisen in consequence of the statutory limitations in respect of capital required by gas and other public utility undertakings. Not long afterwards, there was a conference with Sir George Beilby, at which the gas industry, local authorities, and the railway companies were represented, when a compromise on outstanding points was arrived at, much to the relief of all concerned, though the gas industry did not reach the limits where it thought that economy and practicability mingled. It was agreed that the charge for gas should be on the heat-unit basis, and that 100,000 B.Th.U. should be the unit, or "therm." The calorific value is also to be continuously registered by a recording calorimeter of a standard type to be passed by the Metropolitan Gas Referees. The Board of Fuel Research, by the way, has been experimenting with a new type of total-heat recording calorimeter devised by Mr. John F. Simmance (Messrs. Alexander Wright & Co., Ltd.). Another point in the compromise is that gas undertakings are to be allowed to deliver any mixture of gas, free from sulphuretted hydrogen, but not to contain more than 20 p.ct. of inerts for two years, the succeeding two years 18 p.ct., and then a maximum of 15 p.ct. This is better than the original proposal; but still it is a stiff and unnecessary limitation for undertakings that make coal gas only. As to pressure, the proposal was modified to a minimum of 20-10ths of an inch in any main or service of 2 in. diameter. This is some improvement upon the original suggestion; but Mr. H. E. Jones has severely criticized it in our "Correspondence" columns. However, it is to be realized within a period of five years, so that there may be a good deal of overhauling work to be done upon distribution systems after the years in which they have not received normal attention. In the South Metropolitan and South Suburban Bills, the proposals in the modified report have been adopted.

All this has to be endorsed by Parliament; but as Mr. Garnham Roper pointed out at the British Commercial Gas Association luncheon in October, the fact of agreement would smooth the way considerably for the Board of Trade Bill. Since then the London County Council have given a lead to other local authorities in the matter, by accepting the Board's proposals, as revised. The Committee of the Privy Council for Industrial and Scientific Research have also given the report their blessing. In their annual report, they said: "The work of the Board on gas standards, undertaken at the request of the Board of Trade, seems likely to usher in a new era in the relations of the consumers and the gas companies at the moment when the need for economy and efficiency in gas practice is more insistent than it has ever been since the industry was founded." The report means not only a higher standard of efficiency in the industry in producing from the coal used a large yield of potential heat units, but that a higher standard of supervision will be required, and even in the smaller works sufficient knowledge of chemistry will be necessary to keep the inerts within bounds, while the recording calorimeter and an ordinary calorimeter (for checking purposes) will become as necessary as any other part of the gas-making plant. The chemists working in the gas industry have been making contributions on these matters to the proceedings of the technical organizations.

There has been much controversy as to the proper unit to be adopted for the heat-unit basis of charge. Some have had a preference for the equivalent of the electrical unit (3420 B.Th.U.), and the sale at three, four, or five units a penny as the case may be. Others have preferred 10,000

B.Th.U. But the agreement has settled all contention, though not belief, as to which would be the best, by putting the unit at 100,000 B.Th.U.—a figure that was first suggested by Dr. Carpenter, and subsequently supported by argument by "Gas Engineer" in an article contributed to our columns.

The heat-unit scheme gives the gas industry a great deal more elasticity in its manufacturing and trading operations; and it will help coal conservation. But it is clear that the undertakings that make only straight coal gas, and which cling to a high calorific value per cubic foot, will be at a disadvantage, in that they will not have so many B.Th.U. for sale per ton of coal. They will be setting limitations about themselves. But this is the business of the directors; and directors must not forget that shareholders also have a right to a voice in the matter.

The report did not escape attack. Prof. W. A. Bone, in his Cantor Lectures at the Royal Society of Arts, made some comments on the percentage of methane gas and the range of explosibility of gases, and as to the toxic character of carbon monoxide. And at the meeting of the British Association at Bournemouth, the revived Fuel Economy Committee, of which Prof. Bone is Chairman, criticized the report very severely, and suggested the forging of stronger chains for the gas industry. These super-refiners would have had the gas industry restricted to a calorific value of 450 B.Th.U. gross, to a minimum of 20 p.ct. of methane, to a maximum of 20 p.ct. of carbon monoxide, and to not more than 12 p.ct. of inerts. The Committee totally ignored practical experience—particularly the experience gained during the war—and favoured the tethering of a great industry to laboratory refinements, which cannot be in ordinary circumstances economically reproduced in working practice, thus limiting progressive service. But the report has had no effect; and the object has been completely nullified as it deserved to be.

The Fuel Research Station.

During the discussion on the report, and the same during a discussion on fuel economy at the Iron and Steel Institute meeting, as well as in the newspapers, attacks were made on the policy of the Fuel Research Board, and particularly regarding the delay that there has been in completing and bringing into use the Fuel Research Station at East Greenwich. The Board are no more responsible for the delay than are their critics, some of whom were more remarkable for a raspy tongue than a courteous tone. Labour and materials, plant delay, site troubles, and a change for which the Board were not responsible in the plans for the buildings, were the inexorable causes of what happened. Most of these difficulties being common to the whole country, the critics, had they been less obsessed by the importance of their own opinions, might have anticipated that the Board were the victims of a universal disability. We shall now soon be hearing of the work that is actually proceeding at East Greenwich. In their annual report the Privy Council Committee for Scientific and Industrial Research stated that the cost of the buildings and equipment was estimated by the Office of Works at £188,000; and in their estimate the Committee had provided the sum of £8000 for experimental plant during the current year. Engineer-Commander Fraser has been appointed Engineer-in-Chief of the Fuel Research Station.

Emergency Calorific Standards.

The standard of 450 B.Th.U. gross which the Board of Trade and the Coal Controller directed might be observed owing to the position of coal supplies, was due to expire at the end of June; but it was quite clear from the dismal position of coal supplies, and the impossibility of accumulating adequate stocks, that it would have to be continued. The sanction was carried forward to the end of October; and, in view of the Board of Fuel Research report, there could have been little compunction on the part of the Board of Trade in taking the step. Something else happened in this year of surprises. This was the national railway strike; and through the impossibility of moving coal about the country by rail, the fiat went forth that all gas undertakings must produce gas of a value not exceeding 425 B.Th.U. gross; and those who infringed the Order would be liable to a penalty. Putting 425 B.Th.U. as the maximum was a mistake, but a quite innocent one. There is no difficulty for those with water-gas plants or steaming arrangements to get down to 425 B.Th.U., and much lower; but it is not so easy for those with coal-gas plants only without heavy dilution with inerts, and there is no advantage from the economy point of view in doing this. Another obstacle is that consumers' appliances require readjustment for such gas when a much higher quality has been supplied. Satisfaction can be given, and is being given, with a low calorific grade of gas; but this is not to be accomplished by making a precipitate descent from a high-grade gas to a low-grade gas. It should be done in stages, and proper arrangements should be made for doing it. The proof of this is found in the fact that some undertakings are giving satisfaction with 400 B.Th.U. gas; others could not do so with 425 B.Th.U. gas, and so had to get back to 450 B.Th.U. A further cause of trouble was that, owing to the position of coal stocks, it was necessary to reduce pressures. There were complaints of bad gas; but as with proper adjustment and pressure, and uniformity of specific gravity, it is possible to get equal thermal efficiency from low-grade as from high-grade gas, the description of "bad gas" was merely the product of indifferent knowledge. There was some irritation felt in the gas industry, when the London County Council announced the fact that the South Metropolitan Gas Company throughout the strike had continued to supply gas of an "average" 558·7 B.Th.U., while other gas undertakings had been doing their best to conserve coal by working as closely as conditions would permit to the instructions of the Board of Trade. However, when the conditions eased, the Order was withdrawn. Subsequently, in the House, Sir Auckland Geddes stated that he thought it would be necessary, owing to coal conditions, to renew the suggestion as to the gas industry being free from penalty until the end of April, so long as 450 B.Th.U. gas was supplied. By that time we are hoping the Bill will be before Parliament to carry out the proposals of the Beilby report.

Dilution—Water Gas and Steaming.

We have had many papers and articles on the subject of the dilution of coal gas by blue water gas; and the same on the steaming of charges in continuous vertical retorts of the Glover-West, Woodall-Duckham, and Toogood-Dempster types. Settle's downward steaming—the "Leeds"—process for intermittent retorts has shown a capacity for producing gas equal to 10 million B.Th.U. per ton of coal. The Devon system of steaming the charges in horizontal retorts has had a large adoption; and others are also steaming the charges in horizontals on plans of their own devising. Mr. C. B. Tully's complete gasification system has had a large adoption in small works—especially by those driven into a corner by the cost of coal and the shortness of supply. We had a description of experience in supplying this gas at King's Cliffe, Northants, using a non-caking coal. This particular plant completely gasifies the coal, and makes 40,000 c.ft. of 400 B.Th.U. gas, equal to 16,000,000 B.Th.U. There are several of these plants now in operation at small works, as was indicated in our columns last week.

In regard to charge-steaming, the process stands the test of time. One advantage is the preservation it gives to, and brings into account, those constituents of gas that, without the protective action of the steam, would be destroyed, as they are in ordinary high-temperature practice. Prof. Cobb told us of these things in his enlightening William Young Memorial Lecture in 1918; and we firmly believe that the investigation into the notable working at Uddingston which is being carried out by the Gas Investigation Committee (the Research Chemist in this instance being Dr. A. Parker, with the help of Mr. Lawrence Hislop), is going to provide confirmation of the theoretical deductions which had previously been made. There are indications of this; for Prof. Cobb and Mr. James W. Wood, M.Sc., the Research Chemist examining the behaviour of different grades of gas in use, have both spoken during the year in terms which denote their satisfaction that the system is proving itself a chemical advance, as it has proved itself a practical commercial advance. Prof. Bone in his Cantor Lectures also spoke in terms of approbation of it. Of course, different coals will give different results. We cannot enter into all the considerations here which promote the highest efficiency in working. But with different systems and different coals, Lieut.-Col. Woodall has (this at the Southern Association meeting a few weeks since) given us figures which show productions of gas per ton of coal equal to from 7,056,000

to 14,160,000 B.Th.U. This last-named figure is equal to approximately 50 p.ct. of the original calorific value of the coal. Other details will be found in the paper. We believe that the 14,160,000 B.Th.U. production is with the Glover-West retorts at Uddingston—at any rate, Uddingston has been more progressive than any other works in pushing forward to ascertain what can be done in the way of high gas production under the system, and what is more the gas is sold, and is, Mr. Hislop tells us, giving absolute satisfaction for all purposes. What is done by the Glover-West system (subject always to coal and other conditions of working) can be, reports assure us, done by the Woodall-Duckham and the Toogood-Dempster systems.

It is a matter of note that in all places where the steaming process with vertical retorts is in operation, no complaints are heard from consumers; and there is no intention on the part of the responsible gas engineers to go back, but rather to press forward. Of course, there is rather less coke for sale, but some of it will be saved with the adoption of boilers raising steam from the waste heat of the settings—a process that is now attracting the attention of gas engineers. There are increased yields of both tar and ammonia. Speaking of ammonia, in the report of Mr. J. G. Taplay and Mr. R. B. Parkinson on the internal corrosion of mains and services (which report was presented at the last meeting of the Institution), the point is made that, in the presence of steam and incandescent coke, hydrocyanic acid is converted into ammonia; while conversely ammonia in the absence of steam is converted into hydrocyanic acid by passing over red-hot coke. Nearly all the good effects are the savings from what was formerly waste. Another consideration, too, is the low percentage of inerts—a condition which pleases Sir George Beilby. Settle's downward steaming system with intermittent retorts has, as we have already said, produced splendid testimony for itself. Of course, the same high results cannot be expected from steaming charges in horizontal retorts. It is not the same thing; but good success in paying results has been attained—particularly with the Devon system, which has been developed on the lines that experience has proved to be necessary for the realization of efficient working. The steaming, however, must be properly and methodically carried out. During the year Mr. R. J. Rew gave important information on the subject.

At some works with the steaming systems as much as from 30 p.ct. upwards of coal (we have seen 61 p.ct. mentioned) is being saved compared with former working; and this in the time of dear coal is something that is important. It has, too, its effect on capital per unit of production; and labour costs with the high rate of payment in some cases only work out per 1000 c.ft. to something like it did before steaming was adopted. It is not surprising that the builders of vertical retorts have a considerable number of contracts booked-up. The largest one entered into during the year is that for Glasgow; and it is to be on the Woodall-Duckham system. It is to deal with 1350 tons of coal per day; and a feature is the inclusion of boilers to utilize the waste heat of the settings for raising steam.

A great deal of information, too, has been published during the year of experiences in the mixing of blue water gas (made separately) with coal gas; and the advantages of scientific control in the making of the water gas has been emphasized—particularly by Mr. W. W. Townsend in his Eastern Counties paper. The commercial value of blue water gas as a diluent is proved; but there are many who prefer slight carburetting. This has an acknowledged value in counteracting (more especially when washing for benzol is practised) the troubles that Messrs. Taplay & Parkinson have drawn attention to in their reports to the Institution, both this year and last year, as to meter troubles and internal corrosion of gas-mains. Moderate carburetting will help to eliminate sulphur dioxide; or by passing in the blue water gas before the scrubbers, the ammonia will neutralize the sulphur dioxide. Moderate carburetting further helps to minimize the nuisance from naphthalene where benzol recovery is practised. It also enables the enlargement of the quantity of water gas mixed with the coal gas. At the same time, there are many works using blue water gas with satisfaction and without trouble. There has been some discussion as to the best place for admitting the blue water gas. For convenience under his conditions, Mr. Frank Livesey, at Maidstone, does this at the inlet of the exhausters. But he really favours mixing it at an earlier stage. He believes (as many others do) that by passing the blue water gas along the foul main, it is enriched by picking-up tarry vapours.

GASES OF LOW CALORIFIC GRADE—INERTS.

Next to the opening address of the President (Mr. Samuel Glover) at the annual meeting of the Institution, an important feature of the proceedings was the second report of the Gas Investigation Committee, which was introduced by Prof. Arthur Smithells and Prof. Cobb, and explained by the Research Chemist (Mr. James W. Wood). Research has been carried on at Birmingham, Uddingston, and the Leeds University; this into the efficiency in use of different grades of gas. A new line of investigation has been started—as already pointed out—by Dr. Parker into the methods and the results of vertical retort working (with steaming) at Uddingston; and Mr. Lawrence Hislop is giving all possible aid to the work. The results of the tests upon the use of the Uddingston gas (approximately 400 B.Th.U. gross) clearly indicate that it can be used with good efficiency in both low and high temperature appliances, when the simplest possible modification of the burners tested was made by enlarging the nipple orifices. The tests also on the relative efficiencies of other grades of gas, generally speaking, confirm those of the previous year. It is all a matter of regulation and capacity for passing sufficient gas; but important to the maintenance of results are constancy of the mixture, specific gravity, and pressure of the gas supplied. The reports have, we believe, had good effect in shaping opinion on the low calorific grade gas question.

The much-debated question of inerts has now been settled for the industry by the agreed modification of the Beilby report. The matter had much consideration in the report of the Gas Investigation Committee. The tests show that, providing the CO_2 is not high for purposes in which flame temperature is important, the consumer purchasing B.Th.U. is well protected. It is the maker of the gas who suffers most from having to provide in his plant and distribution system for dealing with a volume of inerts for which he will not receive a penny on the B.Th.U. basis. Steaming or properly made blue water gas reduces the percentage of incombustibles in the mixture, and so increases the percentage of combustibles. Inerts make a difference to the specific gravity; hence the necessity of drawing the line somewhere so as to realize constancy of gas. Mr. Wood, in his Midland Junior Association paper the other day, named 25 p.ct. as a point which it would be well not to exceed; and Dr. E. W. Smith had previously put the figure at 30 p.ct., though it is difficult to see, unless there are money and efficiency advantages to be obtained, the value of distributing even 1 p.ct. more than the (in individual circumstances) unavoidable proportion. The paper by Mr. Wood is well worth study, and so is the William Young Memorial Lecture delivered, by Mr. William Cranfield, to the North British Association. This lecture brings into focus much valuable information bearing upon the subject of lower calorific power gas. During the year, too, the report which Dr. Lessing made to the Directors of the South Suburban Gas Company about two years ago, also through our columns, saw the light of day. It is noted that, though written so long ago, the very first conclusion is that gas should be made on a calorific basis; and one of half-a-dozen other suggestions is that all aromatic hydrocarbons, including naphthalene, should be extracted from the gas.

GAS AND ELECTRICITY AND COAL CONSERVATION.

It will be remembered that the Carbonization Sub-Committee of the Coal Conservation Committee of the Ministry of Reconstruction let the gas industry down rather badly, in their report dated Jan. 18, 1918, by abstaining from effectively showing what the industry was doing in conserving coal by the manner in which it uses it. That they should have shown this was the more essential, in view of the report of the Sub-Committee dealing with electricity which went to extremes in representing, by very strained assumption and giving full play to imagination, what electricity could do in this matter, while by the barrenness of their report the Carbonization Committee practically played into the hands of electricity. We know what happened with the electricity report in hand, and with the subsequent one by the Board of Trade Committee—the two reports having a strong family likeness. The Government took up the matter, and decided to push electricity to extremes. The project was, according to prophecy, going to revolutionize industrially the country; it was the one thing needed for placing its industrial and commercial prosperity on a high pinnacle. From

palace to the home of the rustic, saving of fuel was to come about by its conversion into electricity, and by being sold at a low price for heating, cooking, lighting, and power. There were to be rivers of electricity flowing through the country, and streamlets into every place where there was human habitation; there were rivers of madness on the question set running by responsible politicians under the influence of these romantic reports. There has never been so much drivel and looseness over a question which admittedly is of the utmost importance, and which, as Sir Arthur Duckham has said, should have been dealt with by a competent Commission on the general ground of light, heat, and power, without regard to any one agent.

The Government, however, still smiled benevolently upon the electricity industry. A Bill was drafted to set up Electricity Commissioners and District Boards, and to consolidate generation under these Boards, with generous loans from the Treasury, to enable the work to be vigorously prosecuted. As time went on, the Government cooled down somewhat; but there would have been a loss of prestige, an eating of words, if the scheme had been dropped. So the Government went forward with its Bill, ever and anon publicly blessing it, and pointing out its beneficent objects. The Bill as introduced, however, is not the same thing that it is now. It has been altered, amended, and patched-up; and whole parts have been cut out of it, only to come up again later as a second Bill. It has passed through both Houses. The Electricity Commissioners are still in the Bill; and Sir John Snell is to take the leading part. The Commissioners will have large powers subject to the approval of the Ministry of Transport, and confirmation by Parliament. It is a sore point with the electric supply industry that, against its will, it should have been hitched on to the Ministry of Transport. The vast organization proposed contemplated the division of the country into areas, and a District Board in each, who were to take over all the electric generating plant and the transmission lines, scrap the uneconomical, save the useful, and then steer straight ahead for super-stations. The District Boards (as the Bill left the House of Commons) were optional, if the owners of existing stations brought in an acceptable scheme for constituting a Joint Authority among themselves. The Government were prepared to lend some 20 millions for immediate work, and another 25 millions for loans to the District Boards or Joint Authorities. The money was to be repaid with interest; and the industry was to keep its new machinery in funds. We cannot enter into a description here of all the modifications that were made in the Bill when before Standing Committee B, and when under discussion in the House of Commons. The only amendment sought for by the gas industry, through the National Gas Council, was that a proposed power to supply any form of energy other than electricity was made subject to the consent of authorized distributors of the other forms of energy. The President of the National Gas Council states that the District Electricity Authorities will now have to offer to gas undertakings for purchase any surplus gas that is suitable for town purposes. Later the Bill was introduced to the House of Lords, in which the whole policy, principle, and finance of the Bill and scheme were severely attacked and challenged. Second reading, however, was given to the Bill; and the Committee stage was entered upon a fortnight ago, when, in view of the strength of the opposition in the House of Lords, the Government withdrew all the controversal parts of the measure—district boards, purchase of generation stations and transmission lines, and the financial clauses, other than the advance of 20 millions sterling for interim works. The idea was to give time for greater parliamentary inquiry, but not to sacrifice the questioned parts. These will be assembled in a supplementary Bill early in the new session. Meantime the Electricity Commissioners are to go on with their much limited authorization.

It has been noticed that the Government gradually, in public references and discussion, curtailed the anticipated blessings of the scheme to the supply of power for industry. Ridicule had been poured with unsparing hand upon the inflated notions that had been spread broadcast; and competent men had been at work upon definite criticism, over which the authors of the scheme have been wisely silent. Prof. Cobb presented a clearly reasoned criticism, supported by data, in an article in the "Edinburgh Review." Prof. Bone, in his Cantor Lectures, dealt with the subject. There later followed the paper by Sir Dugald Clerk before the Society of Arts (on which occasion Lord Moulton described the use of electricity for heating purposes as a "ghastly waste"). Towards the end of the year, another paper on the same subject by Sir Dugald was read before the British Commercial Gas Association. Between these two dates, there came the report prepared on behalf of the gas industry, through the Institution of Gas Engineers, by Sir Dugald Clerk and Profs. Smithells and Cobb, which showed beyond refutation the superior place that gas occupied to electricity in the matter of coal conservation. This report will live as a classic. There has been no reply to it—only two or three articles in the electrical press, the most prominent feature of which was the disclosure that the writers knew little about the subject. The efficiency of the gas industry in relation to coal conservation stands unapproached by the electricity industry. An industry that can show a thermal balance-sheet attesting an efficiency of 70 to 80 p.ct., and is moving in the neighbourhood of 90 p.ct., need have little fear of the competition of an industry that can only show to-day an average efficiency of between 6 and 7 p.ct.; and if fortune would endow the country with all the conditions necessary to attain the highest efficiency yet secured by any one station in peculiarly fortunate circumstances, the efficiency would still be under 20 p.ct. It was due to the inflated and misleading talk throughout the country by those who did not know anything about the question, that the gas industry moved to have the matter properly viewed from all points in respect of light, heat, and power, in the defence of its own position, which ignorance tried to overlook. We cannot here enter into details of what was done. It would be too big a task in this retrospect.

But while the Government are trying to place the electricity industry in a position to raise the efficiency of generation, they seem to overlook the fact that fuel represents only some 25 p.ct. of the total cost of electricity generation, and that it is capital that stands out the boldest in the costs. And it is capital that is going to swell under present costs for material and labour. They ignore the fact, too, that in the works' costs of industry generally—power is but a relatively small percentage, and that the way to greater industrial prosperity lies in other directions—plenty of material at reasonable cost, labour at fair rates of pay, and labour co-operating to build-up the country. While there has been so much insensate talk, the gas industry has been saving coal, and is working towards increasing production from the coal it uses. This has been seen in dealing with the steaming of charges, and the utilization of a proportion of coke for gas-making. At the Eastern Counties Gas Association meeting last October, Mr. W. F. Goodrich, of the Coal Controller's Department, estimated that in the previous twelve months the gas industry had saved 3¼ million tons of coal through these two processes. For the month of September, the average number of works in operation where water gas was being made (speaking in the broadest terms) was 270; and in the twelve months 260; the average percentage of water gas being 20·29. About 100 works were using vertical retorts; and 25 new installations were then in hand. Some 205 works were making blue water gas; and there were some 50 plants or so on order. The system of steaming horizontal retorts has been adopted in about 160 works. This is only the beginning of things, but the industry certainly has done well.

A GENERAL GLANCE ROUND.

OUR ORGANIZATIONS.

We have in the foregoing traced—perhaps very inadequately, but to the extent that space permits us to go—the events and changes that are going to have more or less permanent effect upon the fortunes of the gas industry. In connection with all these events and changes, the Central Executive Board of the National Gas Council have had to work hard; and if there is one person more than another to whom the industry is deeply indebted, we say without hesitation that it is the President of the body (Mr. D. Milne Watson). He has worked for the industry, while there are others who have stood aside and spent more time in obstructive criticism than in rendering effective help. The men of the industry will not forget. In its reconstituted form, the Council is strong and independent. It will soon have offices of its own from which to work, and which will be worthy of the industry. Mr. E. J. Fottrell, B.Sc., Assoc. M.Inst.C.E., is now the chief executive officer, or Manager,

of the Council; and Mr. W. J. Smith has had his efficient services as Acting Secretary rewarded by being appointed to the Secretaryship.

The Institution of Gas Engineers has in several matters given very genuine aid to the National Gas Council The annual meeting of the Institution, under the presidency of Mr. Samuel Glover, was a conspicuous success. Some of the topics brought before the members have already been incidentally referred to in this review. Sir Dugald Clerk is now the President; and fortunately, for he is in the position to render distinguished service to the industry in these critical times. And as all the men of the industry know, he has already done so. In the autumn several members (with the Senior Vice-President, Mr. Thomas Goulden, at their head) participated in the allied trip of gas engineers to Paris and the Marne and Somme battlefields, which visit was organized by the Société Technique du Gaz. In conjunction with this trip, there was a banquet in Paris on the invitation of the President and members of the Société. The courtesy of M. Rouland (Past-President), M. Laurain (President), and their colleagues throughout the visit will be treasured in the memories of all who took part in the inspection of great areas of country, and cities, towns, and villages, wrecked and laid waste by the will and acts of a ruthless enemy. While referring to the Institution, there should not be omission to mention the excellent and ever-expanding work that is being done for the industry by the Fuel Department of the Leeds University, under the direction of Prof. Cobb, especially in connection with the Gas Investigation Committee, to which allusion has been made in earlier parts of this retrospect.

The British Commercial Gas Association continues its vigorous and successful work; and it is to-day more essential than ever; for competition is going to be stronger and sterner. The electricity supply industry has now its Electrical Development Association, which will, of course, influence the "B.C.G.A." activities, which remark reminds that it must not be forgotten that the propaganda work has not escaped been driven into the stream of increased costs. The Society of British Gas Industries has been invited by the untiring Chairman of the Executive of the Association (Mr. F. W. Goodenough) to remember this. The District Conferences have been resumed during the year; and the annual meeting, under the presidency of Lord Moulton, was a brilliant success. The Association has not neglected any part of its work, which runs in many channels seen and unseen, while giving prominent attention to the housing schemes and other current developments. It has been making extensive use of the report prepared by Sir Dugald Clerk and Prof. Smithells and Prof. Cobb, which shows that in coal conservation the position of the gas industry is superior to that of the electricity industry. The misleading statements that were made in connection with the Government proposals to reconstruct the generating operations of the electricity supply industry, and to do a little boosting on its behalf, compelled the gas industry to step forward in its own defence. The work of preparing the report was taken in hand through the Council of the Institution of Gas Engineers; but the result is for the benefit not only of the industry, but for the country at large.

The Gas Companies' Protection Association has kept a sharp eye upon parliamentary and legal matters; and the Chairman (Mr. H. E. Jones) had plenty of material with which to weave an interesting story for his address at the annual meeting.

The Society of British Gas Industries has had a good year. There has been plenty to engage the various sections, as the report submitted at the recent meeting by the Chairman of the Council (Mr. Samuel Cutler, jun.) fully testified. The President is Sir Arthur Duckham; and he has consented to remain in the office a second year. He is hoping to bring about closer co-operation between gas engineers and the technical workers on the manufacturing side of the industry. Only by co-operation can he see the slightest chance of the maximum progress being effected by the industry. With the changes that are coming about in the manufacture of gas, and with the need for the highest efficiency both in production and use, never was there a time when collaboration was more necessary. The Society has made itself responsible for a paper on the subject of carbonization to be read at the next meeting of the Institution. In the researches into subjects associated with refractory materials and meters, the Society are already co-operating with the Institution. The sections producing gas-meters and gas-consuming plant have had conferences with the National Gas Council regarding prices; and the President of the latter stated recently that he hopes the result of the interviews with the makers would be satisfactory to the industry. On the other hand, the makers hold that their prices will bear the strictest investigation, and are quite consistent with the increase of costs.

The District and Junior Gas Associations have got back to their normal programmes.

The Coke-Oven Managers' Association have held several meetings in the different districts, from which meetings much of technical interest has issued. With the growth of the relations between coke-oven proprietors and the gas industry—respectively as sellers and purchasers of coke-oven gas—mutual interest will be advanced. The year has witnessed considerable augmentation of preliminary and actual steps in the making use by the gas industry of gas from coking plants.

THE GAS BUSINESS.

Notwithstanding the high prices—high compared with the pre-war years, but not in relation to the cost of all other commodities—gas is much wanted by the community and by various industries. The public have rebelled against the price, albeit gas capital has not been allowed fair reward. They have also protested against the increase in the rental for gas appliances—failing to recognize that labour, upkeep, renewals, and all expenses have more than doubled. The National Gas Council have declared that 50 p.ct. increase in the rentals is fully justified. There have been several cases before Profiteering Committees in which gas undertakings have been accused of profiteering; but as the gas undertakings have known, while the complainers have refused to be satisfied with their explanations and assurances, such charges could not possibly be sustained.

The industry has got used to the effect of "Summer Time" upon the lighting load; but the Fuel and Lighting Rationing Order, combined with the drop in gas consumption occasioned by the cessation of munitions work, affected output in some areas. Taking the industry as a whole, the year's business has been well maintained; and not a few actual increases in consumption have occurred. Naturally, the prices of appliances, materials, and labour have put the brake on the rate of progress of new business; but in this respect the industry is not standing still. The suspension of the Fuel and Lighting Rationing Order so far as gas and electricity are concerned, will give a fillip to consumption. The fight is going to be a stern one in the lighting field. The gas-filled—or so-called "half-watt"—electric lamp has issued its challenge; but it is taking the place of its own family predecessors, rather than making any great headway in gaining new business. The cost of the lamps is high; and so is the cost of electrical fitting and installation work. High-pressure gas lighting has been revived, and has received good testimony for efficiency. Improvements are being effected in all gas-using appliances with the view of promoting efficiency and economy. Henceforth, however, all appliances will have to be fitted in a manner that will give a good range of application, so as to be able to deal with gas of lower calorific values than that hitherto supplied. The industry will want all the co-operation the manufacturers can give them. Under the title of "Radiation, Limited," Messrs. John Wright and Co., Ltd., the Richmond Gas Stove and Meter Company, Ltd., and the Davis Gas-Stove Company, Ltd., have linked-up their several interests. There is considerable liveliness in the development of gas-using appliances for domestic and industrial use—from the smallest domestic gas appliance up to industrial furnaces and engines. The manufacturers still have their troubles, with labour—including foundrymen—and high costs of materials. However, when we settle down, if greater efficiency and economy in the production of gas and gas consuming appliances together pull down costs to the consumer, the future of the industry cannot fail to be good. Mention ought not to be omitted of the issue of an extraordinarily interesting and hopeful report by the Gas Traction Committee.

SECONDARY PRODUCTS.

As to secondary products, at one time in the year, there were reports as to coke stocks being on an ascending scale. Generally speaking, they have not been heavy, and are now well down. The price has followed that of coal, with

the exception of the increase due to the substitution of Durham seaborne coal in place of Yorkshire railborne. Regarding tar, prices have been higher than the year before. The agreement with the tar distillers for the sale and purchase on a profit-sharing basis is not altogether out of the wood yet. At the recent meeting of the National Gas Council, it was stated by the President that the agreement had been carried a step further; but the matter had had to be submitted for counsel's opinion, as it is felt that it was drawn up on the lines of a partnership, and so might prevent statutory undertakings becoming parties to it. The outlook for tar is relatively very satisfactory. More undertakings have gone in for tar-distilling, as was shown by Mr. W. S. Curphey in his annual report under the Alkali Works Regulation Act. This report was, like its predecessors, of high technical interest; and more information was supplied as to matters associated with purification and with the direct system of sulphate of ammonia making. This year the Government withdrew the subsidy for sulphate of ammonia; and the farmers have to pay the prices that have been arranged by the Sulphate of Ammonia Association with the Board of Agriculture. They are not what the Association regard as being quite fair to producers; but they are the best that could be agreed upon. Due to the propaganda work of the Board of Agriculture and the Association, the demand for sulphate of ammonia continues to increase. A selling organization (the indications are growing of big competition coming for the overseas trade) has been formed; and export business is now being dealt with through this. Eyes will have to be kept on the progress of plants for the fixation of nitrogen from the atmosphere. Another matter is that there is no difficulty now in rendering sulphate of ammonia neutral; and this is a condition that will in future have to be observed. The supply of sulphuric acid has been better, though the price shows an advance.

The National Benzol Association and a benzol distributing organization are among the births of the year. Mr. Milne Watson is the President of the Association. Restrictions which had hampered the commercial sales of benzol were withdrawn early in the year; and benzol producers and motor car users began taking an increased interest in each other. Some gas undertakings that had been washing for benzol gave up the practice; but many others are contributing to the supply of home-produced motor fuel. The Automobile Association has been conducting a campaign among motorists in favour of the production and use of benzol; and they have given a very complete answer to the attacks that have been made upon its efficiency in use. A 10,000-mile test has just been carried out with a "Sunbeam" car using only benzol, and the average mileage was 24·57 per gallon. Dr. Harold G. Colman examined the conditions and the results of the running from the chemical point of view. All the tests made in the course of the year show there is more power in benzol than in petrol. It was made abundantly clear during the year that if benzol is "bad" for motor use, then it is not benzol that fully complies with the standard of the National Benzol Association. Benzol has been selling at a somewhat lower price than petrol; and when to this difference is added the value of the increased power that there is in benzol over petrol—representing something in the neighbourhood of 15 p.ct., it is seen that there is a money difference greater than is represented by relative prices per gallon. Current prices of national benzol to garages might be taken to be: England and Wales, 50-gallon steel barrels or drums, and road or rail tank loads, 2s. 3d. per gallon. The deposit on barrels or drums is 70s. The price for 2-gallon tins is 2s. 4d. per gallon; deposit for package, 3s. The Scottish prices are all round 1d. per gallon extra. Retailers are allowed to add 5d. per gallon as their profit. In a report by the Inter-Departmental Committee of the Petroleum Executive, the production of alcohol for power use was referred to; and it appears that the production of ethylene from coal gas is under consideration for this purpose. A mixture of benzol and alcohol would go a long way towards meeting our home requirements for motor fuel.

OTHER MATTERS.

There were numerous other questions that occupied consideration during the year. But there was nothing extraordinarily imposing in Parliament, in the Law Courts, or in the Money Market. Naturally the market values of stocks and shares have further descended in response to the higher price of coal and lower dividends. What will happen in the New Year in respect of the 10s. reduction in the part of the coal used for domestic purposes remains to be seen. We do not imagine there will be any great effect. There will be a waiting to see the Board of Trade plans for financial revision; and this, combined with certain Bills of which notice has been given, will, it is hoped, fill next parliamentary session with interest, and its issues with all the glory attaching to the righting of a wrong, and the conferring upon the industry of those powers which will enable it to go forward into larger service. The question of the revision of the salaries of gas officials who have not had adequate consideration in these new times has been much discussed during the year. It is only heard of now and again; and then it appears to get stranded. There have been many official changes—some very important ones. Several lives that have been largely spent in the industry have ended. We mourn for them all, and we miss them.

PRESS FORWARD.

The world, however, moves on. Change succeeds change; development generates development. Changes and developments have to be accepted, and our own courses have to be shaped to them. The past twelvemonth has vividly illustrated this. In the year the dawn of which is upon us, we are looking for great things which will help to re-establish the fortunes of the industry. We trust that there will not be disappointment. But whatever occurs, it is the duty of each and all working within the industry to press forward in the cause of its restoration and development, with the one object of renewing and maintaining for it a large prosperity.

Coal Prices and the Sliding-Scale.

In dealing with the financial revision clauses in the South Metropolitan and South Suburban Gas Companies' Bills in last week's issue, allusion was made to the fact that neither Bill contains any reference to the variation of the standard price by a figure representing changes in the rise or fall of the price of coal. There was recognition in what was then said as to the difficulties surrounding the proposal in order to get it on to a proper workable basis. Dr. Charles Carpenter was originally in favour of protection being obtained for both gas stockholders and consumers in respect of coal prices. Naturally, however, one does not always at the outset see the full difficulties or the full advantages of a proposal; and extended consideration and new conditions throw fresh light on the problem. The suggestion that Dr. Carpenter made for incorporating with the usual sliding-scale an additional scale based on coal prices he now withdraws through a letter that appears in our "Correspondence" columns. His further investigation pronounces the idea an impracticable one. Is there not another course? In the South Suburban Bill, it is proposed to empower the Board of Trade to revise the standard price on the application of the Company or any local authority in the gas-supply area. In considering any such application, the Board of Trade, it is suggested, shall take into consideration any increase or decrease in the cost of manufacturing and distributing gas, other than any increase attributable to defective management or any decrease attributable to the exercise by the Company of due care and management. This is a different thing, of course, from automatic increases or decreases due to the rise or reduction of the price of coal. But it serves to remind us of the New South Wales legislation, which provides that, if at any time the cost of the production and distribution of gas is increased above the average cost of the year 1912, the gas company shall be entitled to have the standard price of gas increased by 1d. per 1000 c.ft. for every 1s. by which the cost of production and distribution is increased. [See "JOURNAL," June 18, pp. 542, 558.] Mr. Charles Hunt, the Chairman of the South Suburban Gas Company, has also a letter on the subject in our "Correspondence" columns to-day.

Cost of Coal Control.

In our "Retrospect" to-day, allusion is made to the work of the Coal Control Department. Altogether, it seems coal control has not only been a costly affair indirectly, but directly. It was stated in the House of Commons last Tuesday that the total cost of the department up to the end of September had been £552,600.

A Terrible Occurrence.

Newcastle at Christmas time was saddened by a terrible catastrophe, which reminds one of the horrible loss of life that

occurred, through a fire electrically caused, at Messrs. Arding & Hobbs in South London on a Christmas Eve a few years ago. The fearful experience at Newcastle occurred on Tuesday; and the scene was in a big commercial building known as Cross House, at the foot of Westgate Road. In the basement, a film business is conducted by Messrs. Collins and Middleton. According to Mr. Collins, about a month ago an electric-stove was installed in the lift from the basement—being attached to a loose extension of the electric cable. A boy who was standing near the lift declared that just as the cage had ascended, there was a flash in the lower part of the shaft, and the flames instantly shot upwards. A lift-shaft, an electric fusion, electric wires presumably in the shaft, films in the basement which caught fire through the excessive heat of the flames in the shaft—no conditions could have been better for generating a fearful fire. A great number of people were in the building at the time; and onlookers say they will never forget the screams and agony which they heard and witnessed. On Tuesday evening, no less than eleven bodies had been removed to the mortuary; and some of them, being terribly charred, could not be identified. There may be more deaths, for the reports say that upwards of forty other people were injured—some to a terrible extent. We will not dwell on the details of the ghastly event. People, however, will still hear of the "safety" of electricity. It is one of the trading points of our competitors.

German Gas-Works Coal Reserves.

The condition of coal stocks at many British gas-works today is a source of much uneasiness; but the stocks are not so diminutive on the average as are those of German gas-works. A Special Correspondent of the "Daily Telegraph" has been inquiring into many things in Germany; and this is one of them. He finds that Herr Geheimer Bergrat Stutz is a great man in Germany; for upon him industries and households depend for coal. Herr Stutz also appears to be a genial and communicative sort of person. He had much to say upon coal supplies generally. From what he said as to gas-works, it appears that in 1918 there was an average of 31 days' coal reserve in the gas-works throughout Germany. In 1918 Berlin had 35 days' reserves. On Oct. 1 this year, the reserves at all the gas-works in the German Empire provided only 1·8 days' supply, and in many places gas-works had been closed. On Oct. 8 last, the Berlin gas-works held only four days' reserve; and quite recently two days' supply was all that was available. The situation in Berlin is a very critical one, because, during the winter months, the railways in Upper Silesia are occasionally snowed-up—thus interfering with the regular delivery of coal to the Metropolis. It is more than likely that, before the winter is over, Berlin will be in darkness from time to time. In order to cope with the emergency, it is intended to institute public kitchens, at which the poorer classes can cook their food when the gas is cut-off from their homes. Needless to say, political difficulties and riots are to be expected if there is no gas for heating or lighting in Berlin. That is something Herr Stutz will try to obviate.

Shorter Railway Hours and Gas Coal.

The workers of the country who have been pressing down working hours, and at the same time have been crying out against the high cost of living, do not seem to appreciate that to their own action more than to anything else (apart from the war) is due the cost troubles from which they are suffering. Take the position of coal and railway hours as an example. Mr. Finlay Gibson (Secretary to the South Wales Coal Owners) states with regard to the position of supplies of coal for household purposes and for gas-works and other industrial undertakings, that a serious position in regard to a shortage for these purposes has arisen entirely owing to congestion on the railways, to delay in transit, and to inability of the railway companies to clear traffic from the collieries for inland destinations. As a result, collieries have been losing a large amount of time. He pointed out that it is absolutely necessary that gas-works should receive their full requirements of coal to enable them to maintain an adequate supply of gas to the public over Christmas and the New Year; and the only method by which this course could be adopted was by reducing deliveries to other industrial works. This can only result in unemployment in the New Year. The present difficulties have no doubt been largely brought about as a result of the reduced hours on the railways, and in other industries. The public and workmen should understand that any hardship which they may suffer is in large measure due to such shortened hours. It is calculated in one quarter that to meet the higher railway costs due to increased wages, shorter hours, and dearer coals, 2s. per ton will have to be put upon the rates for carrying coal. This is not a pleasant prospect for gas undertakings.

PERSONAL.

Mr. W. A. BARNETT, who is at present engaged as an assistant at the Nine Elms works of the Gas Light and Coke Company, has been appointed Assistant Engineer and Works Manager to the Barnet District Gas and Water Company. Until June, 1918, Mr. Barnett was at the East Greenwich works of the South Metropolitan Gas Company; and then he was for a short period at the Air Ministry, engaged on work in connection with aero-engine design.

On account of ill-health, Mr. H. B. CHAMBERLAIN, Engineer and Manager of the Trowbridge Station of the British Gas Light Company, Ltd., has unfortunately had to ask the Directors to release him from his duties, and allow him to retire from the Company's service at the end of the year. To this they have agreed, and have granted him a well-deserved retiring allowance. Mr. Chamberlain has been with the Company for over forty years. He commenced his service at their Norwich station in October, 1879; and for four years out of the seven years during which he remained there, he was assistant to Mr. F. E. Linging, who was their Engineer and Manager of that station. In 1886 Mr. Chamberlain was appointed Engineer and Manager of the Company's Holywell station; and some seventeen years later he took up the position at Trowbridge which he is now about to relinquish.

OBITUARY.

HENRY HYMAN SALOMONS.

IT was with regret that we learned of the death, which took place on Christmas Day in Brussels, of Mr. Henry Hyman Salomons, late Manager of the works in that city of the Imperial Continental Gas Association. His long life brought him many friends, and one of the firmest of these was Mr. Robert W. Wilson (Secretary of the Association) who, while grieving over his loss, is able to recall the pleasure of working in constant harmony with him for a period of over 47 years. After retiring from active service in 1912, Mr. Salomons continued to display a lively interest in all that concerned the gas industry generally, and the Imperial Continental Gas Association in particular; and he was a constant visitor at the Association's offices in London.

There was, indeed, no more devoted officer of the Association than Mr. Salomons; and the universal esteem and affection in which he was held was amply demonstrated on the occasion of the celebration of his jubilee of service with the Association. It was on Feb. 21, 1911, that Mr. Salomons, who was at that time Engineer-in-Charge of the Brussels station of the Imperial Continental Gas Association, completed fifty years' connection with the Association; and in celebration of the event, the Chairman and Directors entertained him at a dinner in Brussels, which was also attended by the managers of the other works of the Association. Souvenirs of the event included a suitably inscribed gold watch, the gift of the Directors, and presentations by his colleagues on the engineering staff and the workmen. In connection also with the jubilee, a deputation from the Dutch and Belgian Gas Associations, headed by their respective Presidents, waited upon Mr. Salomons at his residence, and presented him with an illuminated address and an artistic bronze; while he was the recipient of congratulations from the Société Technique du Gaz en France, and from the authorities of the principal communes lighted by the Association. In the following year, he received at the hands of the King of the Belgians a coveted distinction—being decorated with the "Ordre de la Couronne."

It was at Antwerp in 1861, when he was sixteen years of age, that Mr. Salomons entered the service of the Association as pupil-engineer. Five years later he was transferred to Toulouse, and then to Bordeaux; returning to Antwerp in 1876. He remained there for some eighteen months, and then spent a short time in Vienna. In 1879 he was appointed Engineer-in-Charge at Haarlem; and five years later he was entrusted, in addition, with the supervision of the Rotterdam station. Then in 1888 he was made Engineer-in-Charge at Amsterdam, being relieved of his duties at Rotterdam; and in December, 1898, he was appointed Engineer-in-Charge of the works at Brussels. At the annual meeting of the Association in 1912, the Chairman (Mr. J. Horsley Palmer) announced that Mr. Salomons had retired on his pension as from May 1 of that year.

Mr. HENRY DOWNS, who had for the past 21 years filled the position of Secretary and Treasurer of the Bothwell and Uddingston Gas Company, Ltd., died of pneumonia on the 19th inst.

ELECTRICITY SUPPLY MEMORANDA.

Christmas time does not provide the electricity supply industry with many incentives to joyful mood. Things are not as they had hoped for. Some of its men, however, have found satisfaction in the position to which the new legislation for the industry has been brought; and they are hoping that the first instalment of the legislation will be the last, as they are convinced it is quite sufficient. On the other hand, they now know that the Government are disinclined to resign the postponed clauses; and they hear that, no matter what the Lords may think or do, the Government intend that the suspended clauses shall go through next session. There are other electrical men—of the revolutionary type—who want the whole Bill, but have learned that even in legislative matters there may be many a slip between Government proposals and absolute enactment. The legislative position is surrounded by uncertainty. There are other matters of a nature that are certainly calculated to cause depression. Electricity has always taken the lead in costliness for light, heat, and power, though admittedly it is endowed with a certain amount of convenience for lighting and power which, according to situation and purpose, places the question of cost in a secondary place. But costs have risen so considerably that the electricity industry is feeling very heavily the effects. Electrical costs show-up with (to electricians) tantalizing boldness under the new order of things compared with those of competitors who can give a greater amount of light, or heat, or power for a given outlay. From generating station throughout distribution to the consumers' equipment, everything required has something special about it. Mechanical plant is very costly now, copper is highly expensive, and the instruments of various kinds required in electrical work are not by any means cheap to produce. All appliances for consumers are more costly than their gas equivalents; and estimates of installation expenses make the householders' hair stand on end, if he is fortunate enough to have retained it during the war. Electrical workers have just received another 5s. advance; and the outgoings for coal and labour show no inclination to recede from present figures. Coal, indeed, has a current price based on such a doubtful foundation—the balance of profits on export coal over home losses—that there is no knowing what will happen in regard to it. If it does anything, it may go up. The chances of the price of energy dropping beyond anything accruing from the 10s. per ton on coal used for domestic purposes are therefore very slender. Expensive as coal is, its quality is much poorer than when it was a great deal cheaper; and there are not a few stations that find their boiler plant inadequate with this lower-grade fuel. Thus the supply of current is frequently in jeopardy; and there are some stations working under supply restrictions. The life of an electrical engineer is not a particular happy one at the moment, though the electrical papers try to keep a good face on matters.

The General Situation.

The House of Commons yesterday week accepted the position into which the Electricity Supply Bill has been thrust by the Lords, who mean that business methods must govern their procedure if they are going to be of any real use to the country. Now that the Government are out with their reconstruction plans, there will have to be greater reliance than ever upon the House of Lords. They will have to make very close and judicial examination of projects, and refuse to be hustled into agreeing with schemes until they have had fair opportunity for investigation; and then their decision must be free. There is reason, too, for the country declining to allow the House of Lords to be bullied into acceptance of schemes. If the House is not to exercise its discretion in legislative matters, then it might just as well have its roots pulled out of our constitutional system, and done with it. Its value was seen in connection with the Electricity Supply Bill; and what happened commends itself to a large number of men in the electricity industry, and a greater number of business men outside it. Now, however, what do we find? The only proper interpretation that can be made of certain remarks in the House of Commons yesterday week is that the Government agreed to the course that was taken in suspending part of the Bill for further consideration solely with the view of getting the other part passed in the session just closed, so that the Electricity Commissioners could get to work. Then when the suspended parts come along again forming a Bill of their own—a little Bill with vast significance attaching to it—the Government appear inclined to say "No" to anything that is not a complete acceptance of their proposals. If this is so, then the further time for consideration, and the consideration itself, will be all a farce. When the Home Secretary (Mr. Shortt) was telling the House of Commons about the arrangements with the Lords, he stated that the Bill containing the suspended clauses would reach the Lords by the end of February or the beginning of March. And he added: "There is no question of abandoning any portion of the Bill, or of giving up a single provision by way of bargain." Later Mr. Hogge asked whether, if the compulsory District Boards were in the Bill to be introduced next session, the Government were prepared to press them upon the House of Lords, even to the extent of the Parliament Act; and Mr. Shortt replied "Certainly." Sir Eric Geddes also said that there was no intention on the part of the Government to drop the clauses that had been removed from the Bill; they had merely been postponed. If the Government can find a means of getting the second Bill through without reconsidering the whole matter in the Commons, they will do so—ostensibly for the purpose of saving the time of the House, but really because there are indications that what has happened in the House of Lords has opened the eyes of many members of the House of Commons to the fact that the Electricity Bill as they agreed to it has more behind it than appears on the surface. And what is behind it has not a good appearance, either financially or politically. The Government are not quite so sure now of the same backing in the Commons.

The Government's Resolve.

There was a serious grumble in at least one of the electrical papers at the opening of the new session of Parliament at the beginning of this year that His Majesty the King in his speech had overlooked the electrical legislation that was going to make the country rejoice, but has failed to achieve anything of the kind. However, for that neglect, His Majesty has made full amends on the occasion of the prorogation of Parliament. In the penultimate paragraph of his address, he says: "The pressure on the time of Parliament has made it impossible to enact in its entirety the Electricity Supply Bill as passed by the House of Commons. Provision has, however, been made which enables the necessary Commissioners to be established, and the preliminary steps to be taken in the reorganization of this vital industry. A portion of this Bill was temporarily postponed, with the object of giving adequate time to Parliament to deliberate fully upon its terms. It is greatly hoped, however, that on the reassembling of Parliament consideration of the remaining portion will be resumed." Our only regret is that His Majesty did not give the paragraph a more prominent place in the address. The two regrets of the electrical industry will be that he had not something better to say about the Bill, and that the industry's affairs were pushed-off to the tail-end of the session as though of minor account, just as its generating work is to be coupled-up at the rear part of the concerns of the Ministry of Transport.

The King's Recognition.

"Meteor" of the "Electrical Times" the other day was almost hilarious over the fact that the "Glasgow Observer" has been making a sweeping indictment of Glasgow gas and gas-fires. The former was bad; the latter cheerless. So "Meteor's" heart was glad. But we do not notice from his remarks that the "Observer" recommended electricity to take the place of gas. We seem to remember that not so long ago Glasgow had a number of "all-electric" bungalows in one part of its suburbs; but the last heard of the matter was that only one or two of the bungalows remained faithful to the all-electric idea. The writer in the "Observer" appears rather to favour smokeless fuels, and so probably he has been giving a hearing to some low-temperature adherent. There is nothing very peculiar about Glasgow gas having been somewhat below the mark—not in its heating efficiency probably so much as in its pressure, and therefore quantity. We entertain no suspicion that Glasgow has been served more abundantly with coal, or coal of better quality, than other gas and industrial works. A glance down the news items of our electrical contemporaries for the last week or two shows us that shortage of coal and coal of inferior quality have had painful effects upon the electric supplies of Hull and Buckingham, and no doubt they are not isolated cases. The electricity consumers have had to go short, and restrictions have had to be imposed. There have been complaints at Dewsbury, too, of inadequate supply; and St. Pancras has had to appeal to consumers to curtail their consumption. Hull, Bradford, Fulham, and Guildford are among the latest towns that have experienced collapses of supply. These are little events that do not trouble "Meteor." He is far more impressed with the splutterings of the "Glasgow Observer" over a temporary condition of things in regard to the gas supply. What is said by the paper about gas-fires does not make so much impression on our mind as the entries in the books of gas undertakings showing the orders of consumers for gas-fires, and many of them repeat orders. There we have a mass of favourable opinion, against which the quips of the "Glasgow Observer" and "Meteor's" joy look small and hardly worth notice. The number of electric-fires that gas-fires have displaced are not a few; but it is more convenient to "Meteor" not to look at home to see what is happening there. He prefers his mirth over gas to be unalloyed by dismal facts electrically generated—for instance, Newcastle, regarding which a paragraph appears in an earlier column.

Cheap Pleasure.

Heating matters are now engaging attention; but a correspondent in the "Electrical Review" (Mr. Charles G. Huntley) calls attention to the danger of standardizing heat requirements according to the cubical area of a room, without taking account of other conditions. The rule generally laid down by electrical advisers is that 1 to 1½ watts per cubic foot is a good figure to take when deciding upon the size of fire for a room. While this figure may, Mr. Huntley says, be safe for a room situated in the best position, it is far too low in other cases. He mentions two examples to illustrate his point. In both cases the rooms are 14 ft. by 12 ft. by

Danger of Standardizing Heat Requirements.

10 ft. high with 9-in. main walls and 4½-in. partition walls. The temperature of the outside air is taken at 32° Fahr., and the required inside temperature at 60° Fahr. Each room has a 6 ft. by 6 ft. window in the main wall. Case I. is a room facing south—only one outside wall, and situated next to a kitchen in which the temperature is assumed to be constant at about 50° Fahr. Taking into account all radiation losses through walls, ceilings, windows, and floors, and assuming only one change of air per hour, the B.Th.U. per hour necessary to maintain an internal temperature of 60° Fahr. are approximately 7000, which when converted into watts give an electric fire requirement of approximately 2000 watts. Case II. is a similar room, but the window faces north; and, in addition, French windows 6 ft. by 8 ft, lead into a garden facing east. To maintain the required temperature in cold weather requires 10,000 B.Th.U. per hour—equivalent to an electric fire of approximately 3000 watts. Calculating upon the general basis of 1¼ watts per cubic foot, the fire consumption in each case would have been taken as 2100 watts, and a 2-KW. fire probably installed; and the users of one of the rooms would have had very unpleasant feelings. Mr. Huntley suggests that it is always advisable to call in a heating expert to co-operate with the architect. This depends on the heating "expert." Three units of electricity at 2d. or 2½d. per unit per hour is something to be considered.

"Half-Watt" Shop-Lamp Contracts.

The Fulham Electricity Supply Committee give an indication of the charges which they think it is proper to make for outside shop lighting with the so-called "half-watt" lamp. They propose to provide a suitable lantern fitted with one 300-watt lamp (covering fixing, cleaning, repairs, maintenance and renewals) at an annual charge of £3 12s.—the electricity to be passed through the consumer's meter, and charged for in the ordinary way. The proposed charge includes: Cost of lantern (£2 5s.) for three years' life, 15s. per annum; renewals, one 300-watt gas-filled lamp, £1; cleaning (on the basis of one man attending to 150 lanterns per week), £1 10s.; repairs, painting, and sundries, 7s.—total, £3 12s. Gas men will compare these charges with their own for outside shop lamps.

SIXTY YEARS AGO.

[From the "Journal" for December, 1859.]

Competition in Gas Supply.—The November "Gazette" notices, preparatory to projected applications to Parliament, include eighteen affecting more or less the interests of gas companies. Some of them are of the usual speculative class resorted to by Local Boards when some point is to be carried by the exercise of undue pressure on a timid body of gas proprietors; and several of them will probably not reach the next stage, which involves the expense of preparing and lodging the copy of a Bill. Such probably are those given by the Local Authorities of Brighton, Richmond, Macclesfield, and Oxford; and it is doubtful whether those given by the promoters of the two rival candidates for the honours and profits to be gained in a competition with the Imperial Gas Company in the Borough of Marylebone have any more substantial foundation than the excessive zeal of engineers, lawyers, and contractors to provide themselves with work. Upon this class of speculators even the lesson to be learnt from the experience of the last session in the summary rejection of the Marylebone Gas Consumers' Bill, appears to be thrown away, though it is notorious that a large portion of the expenses incurred in promoting that Bill are still unliquidated, and are likely to remain so, thanks to the Limited Liability Act, which in truth serves as a premium to dishonesty by protecting the promoters of bubble schemes when there are no funds for the payment of the expenses incurred.

The present promoters of these two projects will do well to reflect that there is no precedent on record since the passing of the Gas-Works Clauses Act in 1847 of parliamentary powers having been granted to any competing gas company where the company in actual possession of the ground was already under the *régime* of that Act. The Legislature seems gradually to have arrived at the conviction that competition between fixed capital was an illusion; and the Act was passed for the purpose of regulating the monopolies which gas companies practically possessed, although they were, and still are, liable to competition if they abuse or misuse their powers to such an extent as to induce the Legislature to interfere. The Imperial Gas Company adopted the Act in 1854; and the Governor of the Company very justly observed at the last general meeting of the shareholders, in remarking upon the expenses incurred in opposing the last project: "This waste of money is much to be deplored, because the practical effect is that it postpones to an indefinite time that which we have so much at interest—a reduction in the price of our gas." The present projects are obviously put forward by speculators whose sole object is to cut out work for themselves; and we predict for them a repetition of the fate of the previous project, should they reach the threshold of the Houses of Parliament.

Our Children.—It is a time-honoured and a goodly custom at this season of the year for paterfamilias to gather his offspring around him, to introduce them to his friends, and to rejoice and make merry. He feels proud in presenting Tom, Dick, Harry, and Jonathan as chips of the old block, and enjoys the thought that they will preserve the family name, and assist in handing down to posterity the hard-earned reputation he has acquired. We beg to be permitted to share with Paterfamilias these pleasures of the season, and to introduce to our many friends the offspring of the "JOURNAL OF GAS LIGHTING," now assembled round our table from various parts of the world.

A POPULAR CHEMICAL DICTIONARY.*

ALREADY the author of several books on chemistry, Mr. C. T. Kingzett has now turned his attention to the compilation of a dictionary, in which his aim has been to give in one volume, in compendious form and simple language, descriptions of the subjects of chemistry—its laws and processes, the chemical elements, the more important inorganic and organic compounds and their preparation or manufacture and applications, together with illustrated descriptions of chemical apparatus.

The result is a book [just published] of convenient size, consisting of nearly 400 pages of matter, with about 80 illustrations. At some time or another the author must himself have felt the need of having comprised in a single volume precisely the kind of information that he has here put together; and this being so, it was a safe assumption that other chemists would experience the want of such a book. But though no doubt this reasoning is correct so far as it goes, it does not by any means entirely explain the fulfilment by Mr. Kingzett of his self-imposed task. His endeavour, as he himself says, has been to produce a popular educational work which will incidentally serve as an advanced companion to his "Chemistry for Beginners and School Use," and as a general work of reference, not only to many practical chemists, but more particularly to that larger body of the public who, in the course of their various callings, have occasion to deal or take interest in the thousand-and-one subjects and substances of which descriptions are given.

A work of this character must be judged by the success with which it meets demands when they may be made upon it; but the author has included so much information upon so wide a range of subjects that this success can hardly fail to be considerable. The book should prove a useful addition to the reference library.

* "Popular Chemical Dictionary," by C. T. Kingzett, F.I.C., F.C.S. London: Baillière, Tindall, and Cox, 8, Henrietta Street. Price, 15s. net.

Refractory Problems of the Gas Industry.

One of the contributions to a symposium on refractories presented at the meeting of the American Chemical Society, was by Messrs. W. H. Fulweiler and J. H. Taussig, of the United Gas Improvement Company, who described the plant used for making both coal gas and water gas. Referring to the first-named system, they pointed out that, in order to secure the most economical materials under the rather diverse conditions that exist in a modern retort-bench, it has been necessary to use both silica and fire-clay materials. This gives rise to an extremely complicated problem in the design and construction of these benches, on account of the different co-efficients of expansion of the two classes of material. The average silica material will expand by about $\frac{3}{16}$ in. per foot; while the average fire-clay material, under the same temperature, will probably expand about $\frac{1}{16}$ in. Another consideration—especially in heating-up the setting for the first time—is the fact that silica develops the greater part of its expansion at 300° to 350° C., whereas fire-clay expands gradually up to about 1100° C. Describing a bench of nine retorts, the authors say it will require approximately 76 tons of silica material, and 108 tons of fire-clay material. In water-gas apparatus, there is the effect of high temperatures, abrasion, slagging action, and spalling action. In the selection of material for the generator lining, there has not only to be considered the relatively high temperature, due to the combustion of fuel, but also the action of the clinker as a slag. A very considerable amount of experimental work has been done, with a view to utilizing different grades of refractory material for generator linings; while the use of water-cooled iron surfaces, which have been successfully adopted in producer work, is being seriously considered for at least a small portion of the zone where the greatest corrosive effect is observed. The complexity of requirements has led to the use of a number of laboratory tests, to ensure that material as received will be of suitable character for the use intended. In connection with the general employment of refractories, it has been found that great care must be used in the choice of cements; and it is believed that frequently failures have been attributed to the refractory material when they have really been due to the use of improper cements.

Reasons for the Domestic Use of Coke.—Technical Paper No. 242 of the United States Bureau of Mines, by Messrs. H. Kreisinger and A. C. Fieldner, shows how and why coke should be used for domestic purposes. It should be used because it is smokeless; its consumption makes more gas available to the householder, with more tar and ammonia produced; and, in addition, a coke-fire is easier to tend than a coal-fire, and makes less dirt in the house.

ETHYLENE AS ALCOHOL FROM COKE-OVEN GASES.

A Lecture by Mr. Ernest Bury.

A COMMUNICATION which was in the nature of a lecture was made recently by Mr. Ernest Bury, the General Works Manager to the Skinningrove Iron Company, Ltd., of Saltburn-by-the-Sea, to the Cleveland Institution of Engineers, at Middlesbrough. On approaching Mr. Bury for a copy of the lecture, he stated that no advance copies had been printed; but that the MS. had been forwarded to the "Iron and Coal Trades Review." To this source we are indebted for what follows, which appeared in the issues of our contemporary dated Dec. 19 and 26.

Under the comprehensive title of "Bye-Product Development in the Iron and Steel Industry, with Special Reference to (*a*) the Recovery of Potash from Electrostatically-deposited Cleveland Blast-Furnace Dust; (*b*) the Fixation of Ethylene present in Coke-Oven Gas as Alcohol and its Derivatives," a paper was read before the Cleveland Institution of Engineers by Messrs. ERNEST BURY and O. OLLANDER.

Introducing their subject, the authors explained that the suggestion that Skinningrove should present a paper to the Institution originated from the support given to their Company by Mr. J. J. Burton (the President of the Cleveland Ironmasters' Association), and by this Association as a body to their insistence that a potential potash industry in connection with the Cleveland iron industry should not pass out of their hands. In return for this invaluable support, it followed that the Skinningrove potash results should be placed at the disposal of the district. The occasion seemed opportune for raising generally the question of bye-product recovery at iron and steel works, as a set-off against increasing prices for coal and the growing poverty of our native iron ores; and bearing in mind the growing co-operative spirit of employers in the area, it seemed desirable also to submit recent work carried out at Skinningrove in attempts to recover from coke-oven gas ethyl alcohol and its derivatives, in addition to the ordinary bye-products. The authors further explained that, owing to strikes and other difficulties connected with the erection of plant during the past year, their electrostatic cleaners had not yet been started. They were therefore only able to offer at present the results of their work in the fixation of ethylene. They hoped that before the completion of the present session of the Institution the electrostatic plant and potash recovery from the dust would be fully established, when they hoped to read a further paper. If, on the other hand, they were prevented from completing the plant before the end of February, they proposed to print an account of the data obtained, and circulate it to the ironmasters and members of the Institution.

Continuing, the authors said: The question of fuel economy, which is intimately connected with the removal of ethylene from oven gas, has, during the past decade, become increasingly of vital importance to our iron and steel industries; and at the last September meeting of the Iron and Steel Institute the subject was given paramount importance. The report submitted at that meeting by the British Association Fuel Economy Committee, through Sir Robert Hadfield, Prof. Bone, and Mr. Alfred Hutchinson, indicated that by the employment of modern gas power and blowing engines, coupled with careful coke-oven practice, the whole of the heating and power operations of a self-contained blast-furnace, coke-oven, and steel-works plant may be carried out with the coal charged into the coke-ovens without purchase of any other fuel. It is noteworthy that the technical managers of Cargo Fleet and of our own Company are in entire agreement with this finding, which has been largely derived from actual experience carried out by these two Companies. Neither Company has yet installed the whole of the plant necessary to carry out the scheme in its entirety; but we have obtained sufficient data from actual experience to show that with the plant above specified, and careful team work between departments, the total amount of coal consumed per ton of finished steel can be cut down to 31 to 40 cwt. of coal carbonized, depending upon the nature of the coal employed.

This question of fuel economy is intimately bound-up in the subject under discussion. We suggest that while intensive fuel economy of the kind upon which we ourselves are engaged is vital, we can overstep the mark by burning as fuel liquid products which have a greater commercial value than coal itself. No manager would suggest leaving benzol in his coke-oven gas at a value of £25 per ton, when by extracting it the equivalent calorific value could be replaced by coal even at present prices—viz., 28s. to 31s. per ton. The profits obtained by the extraction of benzol are, in other words, a greater set-off against increased cost of production, coal, &c., than the mere equivalent calorific value which it represents. We must regard the extraction of such valuable chemicals as benzol and alcohol as a set-off to the cost of manufacture of pig-iron and steel, and as potential auxiliaries in the matter of acute competition.

LIQUID FUEL (NATIONAL ASPECT).

Apart from pure commercialism, we have arrived at an age in the world's progress when the internal-combustion engine consuming liquid fuels has become a mainstay of national safety and progress. The late war has indicated that future wars will be won by machines on land, in the air, and under water. We are not a natural oil-producing country, although sustained effort is now being made to discover latent oil resources. We fervently hope that these researches may prove successful. Failing natural resources, we have only manufactured liquid fuel to look to—viz., benzol, shale oils, and whatever else may be discovered. In this, the principal consideration, it seems to us that it is national suicide to continue to burn as raw coal any substance which might be converted into a liquid fuel. The national requirements of motor spirits for all purposes are given at 160 million gallons per annum, against which we have only 30 millions approximately of benzol *plus* the shale fuels, as home-produced motor fuels—the remainder has to be imported from distant countries, which may or may not remain friendly. It is up to us, therefore, to be circumspect while driving for complete fuel economy. The only value which ethylene from coal gas has possessed up to the present, apart from fuel value, is its provision as an illuminant in the old flat-flame household lighting jet; and since the calorific effect can be produced by the remaining constituents of coal gas other than ethylene, simply by increased pressure, it follows that if the ethylene can be economically converted into alcohol, we are now ruthlessly consuming potential motor spirit for household heating, lighting, power-gas engine, commercial heating processes, and the like.

Ethylene is an unsaturated hydrocarbon which burns with a rich, white, smoky flame, and together with benzol, constitutes the illuminating property of coal gas when burned in a flat-flame burner. The term "unsaturated" means that the whole of the carbon valencies or combining links are not saturated with hydrogen, and are therefore free to attach themselves to other radicles. Hence the avidity under prescribed conditions with which ethylene will combine with other bodies.

At this point the authors exhibited a slide showing the following figures.

ALCOHOL AS A NATIONAL ASSET.

Coal coked in bye-product coke-ovens in this country in 1918 reached a total of 14,635,403 tons. One ton of coal has been found to yield 1·6 gallons of absolute alcohol. The annual yield of absolute alcohol is 23,416,640 gallons, which, at 2s. per gallon = £2,341,664.

The above figures (continued the authors) indicate the possibility of alcohol recovery from the country's bye-product coke-ovens at 23·4 millions per annum. If the country's gas-works were to recover their possible ethylene, an additional quantity of 27 million gallons would be available. This would leave our motor spirit condition as follows:—

	Benzol. Million gallons.		Alcohol. Million gallons.
Gas-works	34·0	..	27·0
Coke-oven plant	30·0	..	23·4
	64·0	..	50·4

114·4 million gallons
Against requirements of 160 millions.

It has been jocularly remarked that "you fellows are going to turn steelworks into chemical establishments." Our reply is that the chemical plant is a sheet anchor against depression in the iron and steel trade, and affords increased opportunity for making the most of our raw materials. As such, the chemical industry should be treated in a far more liberal spirit than in the past. The frigid conservation with which the bye-product coking process was received by ironmasters and colliery-owners in this country will be recalled—an attitude which, if persisted in, would have prevented our winning the war, since the products of our bye-product coke-oven industry furnished fully 80 p.ct. of the raw material for the manufacture of high explosives. Without dispute, also, it can be claimed that the bye-product coke-oven has not only redeemed many a third-rate colliery, but has also helped ironworks, and even steelworks, to carry on through bad times. While preaching for continued chemical development, and amplifying still further the function of the bye-product coke-oven, we do not lose sight of the need for every possible improvement in the manufacture of good cheap pig-iron and steel, as indicated by our fuel economy policy. While we are attempting to make more of our bye-products, we have ever before us the main problem—*e.g.*, the greatest production of sound finished steel per ton of pig-iron produced with the maximum fuel economy.

HISTORY.

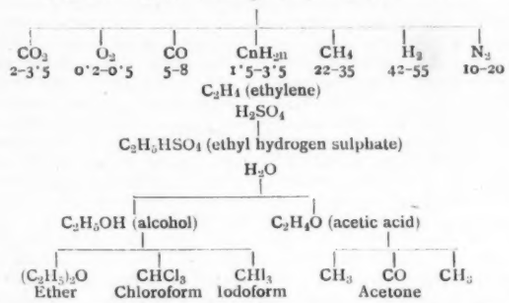
Early in 1912, Mr. Bury suggested to Mr. Alfred Hutchinson that when the principal aims of our iron, steel, and coking plants had been established, the recovery of ethylene would present possibilities of large returns in alcohol and its derivatives—viz., acetic acid, acetone, chloroform, iodoform, and the like. The normal quantity of ethylene and its homologues present in coke-oven gas from Durham coking coal is approximately 2 p.ct. by

volume; so that, given an ordinary chemical works efficiency of 70 p.ct., absorption of this gas as ethyl hydrogen sulphate, with a 70 p.ct. conversion of the latter to alcohol, a yield of 1·6 gallons of absolute alcohol—equal to 3·2 gallons of proof spirit—would be obtained per ton of coal. In other words, a carbonizing plant of the size of Skinningrove, dealing with 5800 tons of coal per week, would produce 9200 gallons of absolute alcohol, or 18,500 gallons of proof spirit, per week.

Slides were exhibited presenting the following figures:

Tree showing Derivation of Alcohol and its Derivatives from Coke-Oven Gas.

Coke-Oven Gas. Average Constitution Per Cent.



Graphic Relationship of Ethylene (C_2H_4) to Alcohol (C_2H_5OH) and Derivatives.

Ethylene	C_2H_4
Ethyl hydrogen sulphate	C_2H_4. H_2SO_4 *i.e.* $C_2H_5HSO_4$
Alcohol	C_2H_4. H_2O C_2H_5OH
Ether	$\{C_2H_4\}$ H_2O *i.e.* $\{C_2H_5\}O$
Acetic acid	$C_2H_4O_2$ *i.e.* CH_3COOH
Acetone	$CH_3.CO.CH_3$

Yields of Alcohol or its Derivatives from a Carbonizing Plant, as at Skinningrove, dealing with 5800 Tons of Coal per Week, taking 50 p.ct. Conversion of Ethylene to Alcohol as actually obtained.

Alcohol	9280 gallons absolute
Acetic acid	7164 gallons 80 p.ct. acid
Ether	6450 gallons
Acetone	5884 gallons

These figures, continued the authors, if the recovery could be made economical, presented very great opportunities for the production of substances ordinarily obtained from food-stuffs, which, apart from works economies, in view of our island position, must always be economized as a matter of national importance. It was agreed finally that this subject must be thoroughly investigated when our principal mission had been executed.

During the progress of the war, increasing quantities of grain were being consumed for the manufacture of alcohol and its derivatives for munition purposes; acetone and ether being required for the manufacture of cordite, &c., and ethylene from alcohol for the manufacture of mustard gas. Mr. Bury put in a provisional patent in 1917 for the recovery of ethylene by concentrated sulphuric acid, calling attention to the possible manufacture of alcohol and its derivatives from coal gas—the object being to prevent waste of food-stuffs. This patent was not completed, in view of the revelation that Fritsche had taken out a similar patent at a much earlier date. A good purpose was served, however, since it drew the attention of the Ministry of Munitions to the possibilities of preparing alcohol from other sources than food-stuffs. In short, if it were possible to make alcohol derivatives from self-contained resources—*i.e.*, from coal-distillation processes—our supplies of food-stuffs would pan-out better, in view of the intensive submarine warfare then being waged.

Shortly afterwards, the manufacture of ethylene from alcohol was commenced at Government factories for the manufacture of mustard gas (dichlor ethyl sulphide); and the Ministry of Munitions, knowing our aims in the direction of ethylene recovery from coal gas, suggested that we should embark on a joint research in this direction. Arrangements were made accordingly. Early in the research, the Ministry suggested that, mustard gas being the crying need at the moment, we should aim at the recovery of ethylene itself, treating this hydrocarbon with sulphur mono-chloride to yield the poison gas dichlor ethyl sulphide, and to this end proposed that the well-known absorptive properties of charcoal should be utilized for removing the ethylene from coke-oven gas. Experiments were carried out at the Universities at Skinningrove, whereby it was shown that, after the abstraction of sulphuretted hydrogen, carbon bisulphide, and carbonic acid, the heavy hydrocarbons contained in the gas could be readily removed—these hydrocarbons consisting of any benzol and its homologues which escaped the benzol scrubbers, *plus* the unsaturated hydrocarbons C_nH_{2m}. It was proposed to pass the purified coke-oven gas, after drying with sulphuric acid, through layers of beech charcoal, which, after saturation, would be removed from the gas and heated to yield ethylene and its homologues—the latter being passed direct into sulpho mono-chloride for the production of mustard gas. The heating of the saturated charcoal would be carried out by passing it through a molten lead bath, a device conceived by Lieutenant Morgan. Later on we, at Skinningrove, found that ordinary peat coke was an equally good absorbent when carbonized at high temperatures, and patented the application. Peat coke is obviously cheaper than charcoal made from timber. We are not a timber-producing country; and our available supplies have been sadly denuded by war demands.

Charcoal or peat coke removes heavy gas, as such, without bringing about any change in composition. The action is not understood; but it can be compared to that of a sponge absorbing water. On heating the charcoal, the absorbed gases are driven off in their primitive state. Gases are absorbed by charcoal roughly in order of their specific gravity; the heavier gases being first removed.

As a war measure there is no doubt that, if hostilities had continued, the coke-ovens in this district would have been called upon to recover direct ethylene by this method. As it was, however, the armistice followed a short time after these facts became assured; and at Skinningrove we had then to consider how far the use of peat coke would be an economic absorbent for a post-war industry, where the liquid derivatives of ethylene were required, and not ethylene gas proper. With this consideration in mind, we arrived at a comparison between the use of charcoal and of sulphuric acid; and at the outset it became apparent that if we could effect a similar degree of absorption with acid to that obtained by charcoal, the former would be preferable, on the following grounds:

(1) Sulphuric acid is a coke-oven product; and the acid required can be obtained from the coal itself. With charcoal we should be dependent on outside resources.

(2) To handle a solid product like peat coke through a large system which is virtually the main artery of the works, is a much more costly and serious problem than pumping a liquid.

(3) The use of charcoal entailed the removal from the gas of carbonic acid. Otherwise the latter gas is absorbed, to the exclusion of the ethylene. The removal of carbonic acid from a large volume of coke-oven gas by lime purifiers or by lime-washing is a serious matter as an industrial process, and is obviated entirely by the use of sulphuric acid.

(4) The heating of a solid substance, such as absorbent peat, on a point of fuel expenditure, is greater than in the case of the direct heating of liquids where more perfect contact can be applied.

(5) By absorption with charcoal, the latter will only take up 1 p.ct. of its weight; whereas we have determined that concentrated sulphuric acid will take up 5·1 p.ct. of its weight before ceasing to be efficient. Therefore, five times the weight of charcoal has to be heated for the expulsion of the ethylene compared with sulphuric acid. This large quantity of charcoal has to be heated to 300° C.; whereas the smaller bulk of acid on concentration has to be heated to 220° C. Therefore, on a point of fuel economy, the acid absorbent predominates.

Finally, we have as yet very little practical information as to how far the sulphur compounds poison the peat coke and render it efficient.

These were the considerations which determined us to adopt the original absorbent, sulphuric acid, where the liquid derivatives of ethylene are desired; but we wish to state that there are many other possibilities where the use of charcoal or peat coke in the purification or selective separation of gases may be of the utmost advantage.

At the outset it became apparent that, whether charcoal or sulphuric acid was to be employed, the recovery of ethylene and the manufacture of alcoholic derivatives could not be made to pay unless the fuel expenditure in the recovery process was cut down to a minimum amount, in view of the inflated price of coal. Furthermore, we were aware that considerable portions of the sulphuric acid after absorption of ethylene are reduced to sulphur dioxide, which, without the recovery of same, would add very considerably to the cost of manufacture. It was with the object of maintaining the economical possibilities of the recovery in these two particulars that the scheme which we will shortly describe was devised.

Absorption of Ethylene by 95 p.ct. Sulphuric Acid (R.O.V.).

After deciding this policy, naturally the first problem which presented itself was the efficiency of absorption of the ethylene by sulphuric acid, and the conditions under which the maximum efficiency could be obtained. On this subject we had very little literature or previous work to guide us. Fritsche had stated that 12 cb.m. of scrubbing surface were required per cb.m. of gas treated per minute; and on account of the very large amount of plant thus rendered necessary, he abandoned the proposal, stating that, even under higher pressures than four atmospheres, the degree of absorption could not be increased. From previous experience we ourselves knew that the rate of absorption at ordinary temperatures was very slow. We also knew there was a limit to which we could raise this temperature owing to the reversibility of the reaction.

Reaction between C_2H_4 and H_2SO_4. Reversible when Absorption Temperatures are too high.

$$C_2H_4\ H_2SO_4 \rightleftharpoons C_2H_5\ HSO_4.$$

At higher temperatures, and in the presence of the water, ether

might likewise be formed, which, by its volatile nature, would pass forward with the gas, and the ethylene radicle would remain unrecovered.

Water is the enemy; and the strongest acid is required. Therefore, if water is present from any cause, absorption of ethylene fails. Water can be present from: (*a*) Natural water in the gas. (*b*) Water from the bad removal of H_2S. $H_2S + H_2SO = 2H_2O + SO_2 + S$. (*c*) From reduction by organic matter on excessive heating. $H_2SO_4 = H_2O + SO_2 + CO + C$.

Local Formation of Ether when Absorption Temperatures are too high.

(1) $C_2H_4 + H_2SO_4 = C_2H_5\,HSO_4$.
(2) $C_2H_5\,HSO_4 + H_2O$ (5% in R.O.V.) $= C_2H_5OH + H_2SO_4$.
(3) $2C_2H_5OH + H_2SO_4 = (C_2H_5)_2O + H_2SO_4 + H_2O$.

In the first place it became necessary to determine the rate of absorption; and instead of employing small laboratory vessels, leaden scrubbing towers 4 ft. high were utilized, from which it was ascertained that, given sufficient scrubbing surface, 70 to 80 p.ct. of the total ethylene could be absorbed by 95 p.ct. sulphuric acid (R.O.V.) at temperatures between 60° to 80° C.

Another set of experiments was conducted by leading coke-oven gas of known ethylene content into a flask maintained at 60° to 80° C., and containing 95 p.ct. R.O.V., and estimating the ethylene remaining unabsorbed at the end of half-minute intervals. The result of these latter experiments was that 71 p.ct. of the total ethylene was removed at the end of two minutes, a rate of absorption which is comparable with the removal of benzol by wash-oil (2·26 to 3·0 minutes).

The function of temperature in bringing about this reaction is of the very greatest importance. As a matter of text-book knowledge, 174° C. is given as the most suitable temperature for the absorption of ethylene by sulphuric acid. But at these temperatures we obtained a jelly-like mass and only a small percentage of the alcohol possible. The reaction was then attempted at 95° C.; but in this case also we obtained a carbon deposit, indicating decomposition. The temperature of absorption was then lowered still further—to 60° to 80° C., at which a 71 p.ct. absorption became established; the acid remaining clear, and containing no carbon particles. Below 30° C. the recovery is not worth while; the maximum lies between 70° and 80° C. Above 80° C. decomposition sets in. Our absorption experiments have been repeated and confirmed many times; and we have now confidence in submitting the temperature conditions as standard. We attribute entirely to these standard temperatures the much more rapid absorption obtained at Skinningrove compared with Fritsche's original investigations.

Treatment of Ethyl Hydrogen Sulphate.

Having ascertained the conditions under which the ethylene may be best absorbed for the manufacture of ethyl sulphate, we had to consider how this product could be further developed in the most economical manner. Two lines presented themselves: (*a*) The oxidation of the ethyl sulphuric acid by electrolysis or ozonized air for the manufacture of acetic acid; (*b*) the hydrolysis of the ethyl sulphate for the manufacture of alcohol and the recovery of the sulphuric acid for re-use in the system. We have satisfied ourselves on both these lines. By electrodes, it has been determined that an 80 p.ct. yield of the acetic acid may be obtained from the ethyl hydrogen sulphate obtained from the gas. We are also content that on hydrolysis of the ethyl hydrogen sulphate with superheated steam, a 70 p.ct. yield of ethyl alcohol may be obtained. We have not yet investigated the nature of the higher alcohols which must be present in the remaining 30 p.ct. The work is now proceeding. The main problem which presented itself in the hydrolysis of the ethyl hydrogen sulphate for the manufacture of alcohol was the limit of dilution of the acid with water, bearing in mind the fact that the acid has to be reconcentrated for re-use in the ethylene scrubbers. The 95 p.ct. sulphuric acid (R.O.V.) used for absorption is reduced by the reaction $C_2H_4 + H_2SO_4$ to 77 p.ct. acid. We have found that we can distil off the alcohol, leaving only traces of ethyl hydrogen sulphate in the spent acid, by admitting superheated steam, reducing the spent acid to only 74 p.ct. We have reason to believe that this figure would be very much improved when working with normal distillation plant; the whole of this work having been carried out with plant constructed from the scrap heap.

Recovery of SO_2.

From the outset we have known that the reduction of SO_2 radical in the absorbent acid to SO_2 takes place to a considerable extent owing to the reducing effect of sundry organic matter collected by the acid; so that on the hydrolysis and distillation of the acid ethyl sulphate, and on the concentration of the spent acid, considerable losses of SO_2 would occur if they were not recovered. The possibility of precipitating sulphuretted hydrogen from coke-oven gas by means of SO_2 (according to the reaction $2H_2S+SO_2=2H_2O+3S$) was discussed between Lieut. Morgan and ourselves in connection with the charcoal method of extraction; and we have since investigated the reaction at Skinningrove with the object of recovering the lost SO_2 from the acid employed on the alcohol plant. By passing the SO_2 waste from the alcohol plant into the coke-oven gas, we have the means for recovering it by reaction, with the H_2S present in the latter—not only purifying the oven gas and preventing the waste of SO_2, but providing the elementary sulphur for giving us the sulphuric acid required for alcohol recovery and sulphate of ammonia manufacture. Any balance of SO_2 required (above that provided by the decomposed acid) would be furnished by burning an adequate portion of the sulphur recovered. In most coals volatile sulphur is present in sufficient quantity to give the sulphuric acid required for the manufacture of sulphate of ammona. Since the sulphuric acid required for the recovery of ethylene is only borrowed, less the amount lost on concentration, it follows (speaking generally) that the waste SO_2 from the alcohol recovery will assist in recovering the volatile sulphur from the coal to be converted into sulphuric acid for all uses.

The sulphur precipitated from coke-oven gas by this reaction would inevitably be in the form of a very fine fume, which at one time we thought of removing by electrostatic deposition. On further consideration, however, it appeared of vital importance to leave the reaction a little short of SO_2, in order to make sure of avoiding an excess of the latter, which would produce corrosion of the mains. On this account, we propose to slightly limit the amount of SO_2 present, leaving traces of H_2S in the gas, and passing the whole of the gas after the reaction through a single oxide purifier, which would serve (1) as a filter for the removal of the sulphur fumes, and (2) to extract the traces of H_2S left in the gas for the purpose of safety against corrosion.

Fuel Economy in the Recovery.

Earlier in this paper we have stated that the economical recovery of alcohol from coke-oven gas was dependent upon strict economy. We have indicated that the absorption of ethylene from coke-oven gas is most efficient at 70° to 80° C. In order to bring about the reaction, both the gas and the absorbent acid have to be heated to this temperature; and since the quantities of gas and acid are respectively 139 and 106 tons per day, this would represent considerable quantities of fuel to bring it to the required temperature. Fortunately, however, in the cooling of the gas in the normal bye-product recovery, sufficient sensible heat is wasted, which can be employed for heating the gas, and so obviate the purchase of any fuel on this account. The wet gases as they leave the hydraulic main at 250° to 300° C. are more than double the volume of the cool gas requiring to be heated, and sufficient heat is therefore available by employing an efficient system of heat exchange to heat the cool gases to 70° to 80° C. The heating of the acid will be carried out by producer gas made from waste coke-dust briquettes; and since the temperature of the acid leaving the concentration plant is 220° C., sufficient waste heat is thus provided in the acid to carry out the reaction in the ethylene scrubbers. Thus the heating of the acid is provided by the concentration process. As to the actual expenditure of fuel in distilling the alcohol from the ethylenated acid, we have no exact figures just at the moment; but bearing in mind the fact that the hydrolysis is effected by superheated steam, and that the reaction between steam and sulphuric acid is exothermic, we only expect a light expenditure in fuel for this part of the process.

The point has been raised that with the removal of the ethylene from the coke-oven gas the calorific value of the gas will seriously suffer. The subjoined figures show how the calorific value of the coke-oven gas is composed according to the percentage of ethylene and other constituents present:

Calorific Value of Constituents of Average Coke-Oven Gas from Durham Coking Coal.

Average Composition.	Volume P.Ct.	B.Th.U. per C.Ft. of Gas.	P.Ct. of Total Calorific Value.
CO_2	2·0	..	..
O_2	0·5	..	..
C_2H_4	2·0	32·1	6·86
CO	5·4	17·6	3·76
CH_4	25·0	255·0	54·53
H_2	50·0	163·0	34·85
N_2	Diff.	467·7	100·00

It will be seen that the ethylene extracted (70 p.ct.) represents only 4·7 p.ct. of the total calorific value. It will be remembered also that, in order to effect the absorption of the ethylene by concentrated sulphuric acid, the gas has to be previously dried by 80 p.ct. sulphuric acid—*i.e.*, the same acid as is required for the sulphate plant; and on calculation it will be found that the dry gas so obtained is only 1·1 p.ct. lower in calorific value than the moist coke-oven gas before ethylene removal.

Inlet Gas Calorific Value.

—	Volume per Cent.	B.Th.U. per Cubic Foot.
CO_2	2·0	..
O_2	0·5	..
C_2H_4	2·0	32·10
CO	5·4	17·60
CH_4	25·0	255·00
H_2	50·0	163·00
N_2 + water vapour	Diff.	467·70

Outlet Gas Calorific Value.

—	Volume per Cent.	B.Th.U. per Cubic Foot.
CO_2	2·08	..
O_2	0·52	..
C_2H_4	0·62	9·95
CO	5·61	18·29
CH_4	25·96	264·72
H_2	51·91	169·23
N_2	13·30	462·26

Difference = 1·1 p.ct.

There is therefore no need for apprehension that, by lowering the calorific value or the calorific intensity by the recovery of the ethylene, the heating of the ovens will be jeopardized. On the other hand, since the moisture is removed by the 80 p.ct. acid, an expenditure in fuel will have to be made at the sulphate plant in compensating for same. But since the sulphate house steam is generated from waste gases, and where proper play is made of the sensible heat of the coke-oven gas entering the sulphate-house, this expenditure is not of serious moment, taken in conjunction with the remaining fuel economies in the recovery of the alcohol against the value of the latter so produced.

The coke-oven gas, after the ethylene absorption, will leave the scrubbers to pass on to the oven flues, steel-works, and soaking pits, at a temperature of 60° to 80° C., where this waste heat is utilized. In other words, the heating of the gas for the recovery of ethylene also does duty in plant where the coke-oven gas is finally consumed.

Having dealt with the main principles underlying the successful recovery of ethylene by means of concentrated sulphuric acid, we will now explain the sequence of the process, in connection with ordinary bye-product recovery plant.

FLOW SHEET.

The hot gases from the oven pass from the hydraulic main to a heat exchanger (in which some of their heat is given up to the cooled and purified gases, as explained above), and thence to the usual plant for the recovery of tar, sulphate of ammonia, naphthalene, and benzol. The cooled gas, after the removal of these products, passes next to a sulphuretted hydrogen purifier, then through oxide purifiers, and thence to a moisture absorber or scrubber in which 80 p.ct. sulphuric acid is circulated, whereby the gas is dried. Then the gas passes to the heat interchanger, in which it is heated by the gases from the carbonizing plant, and thence to the ethylene scrubber. The de-ethylenated gas issuing from these scrubbers passes out to mains conveying it away for use in the heating of coke-ovens, to the steel works, gas-engines, and soaking-pits. The temperature in the scrubbers is maintained in the range between about 60° and 80° C., in which range we have found that the olefines are most efficiently absorbed. The acid with the absorbed olefines in the form of ethyl hydrogen sulphate, issuing from the first scrubber at which the gas enters, passes through a heat exchanger to a primary alcohol still. The acid thence flows to an acid concentrating and heating plant (a Guiard tower), to which heat is supplied from a producer fired with coke breeze, or other practically waste fuel. The re-concentrated acid passes out to a tank, whence it is circulated again through the scrubbers; fresh acid being supplied as required to make up for that which is consumed in the process. A pipe from the alcohol still leads to a condenser in which the crude alcohol is collected. A pipe from the condenser and a pipe from the acid concentrating and heating plant convey the sulphur-dioxide gas which is evolved as a reduction product, to a sulphuretted hydrogen purifier, where it is utilized for reacting with the sulphuretted hydrogen in the coal gas to precipitate sulphur according to the equation:

$$2H_2S + SO_2 = 2H_2O + 3S$$

This sulphur is removed and conveyed to sulphur burning plant, wherein it yields sulphuric acid for use in the scrubbers and in the plant for manufacturing ammonium sulphate.

The preliminary heating of the crude gas from which the normal bye-products (tar, ammonia, benzol, and so forth) have been removed is effected up to a temperature of 60° to 80° C., and the acid for absorption is also heated to this temperature range, because it is found to be essential for the removal of the relatively small percentages of ethylene from the gas as ethyl acid sulphate. The olefine scrubbers in which the absorption takes place may be three or more in number, lined and packed with acid-resisting material, over which the hot acid from the cascade is passed. Here the warmed gas flows over large surfaces moistened with acid, the amount of surface so provided being such as to give the maximum absorption of the olefines. Hot acid pumped out of contact with air is circulated through the scrubbers until the acidity has been reduced by about 18 p.ct. The flow of acid is in counter-current to the gas, so that a constant stream at this degree of concentration passes out from the first olefine scrubber.

The flow of acid leaving the scrubber is passed down a distilling column to the heat exchanger and alcohol still, meeting an upward current of superheated steam. The mixture of alcohol vapour with steam passes from the distilling column to a condenser; the ultimate solution of alcohol and water so condensed being finally distilled over lime to yield absolute alcohol or proof spirit as may be required. The addition of water and steam to the column is minimized as far as possible short of the production of ether and consonant with the complete distillation of the alcohol. The hot diluted acid from the distilling column can be passed by a pipe direct to the re-concentrating plant. The scrubbers may be of a type in which electrostatic deposition is employed, or wherein a ferric-oxide bed filter is used to prevent loss of sulphuretted hydrogen.

CONCLUSIONS.

In conclusion, we have submitted nothing which is new in the matter of pure chemistry. The reactions are all well known. All we claim is the application of these reactions to industrial practice in the preparation of cheap industrial alcohol from coal. We consider the following points as being new:

(1) The temperature, 60 to 80° C., at which the absorption of ethylene by coke-oven gas may be effected so as to give an ordinarily good chemical yield without decomposition of the original products.

(2) The cutting-down of the absorption area required for the removal of the ethylene from coke-oven gas by heating the gas and absorbent acid to 60° to 80° C.

(3) The implementation of waste heat and fuel for the reactions, which has not up to now being utilized for any other purpose.

(4) The utilization of the decomposition product—*i.e.*, SO_2—for recovery of elementary sulphur and simultaneously the purification of the coke-oven gas; the quantity of sulphur so obtained generally being adequate for the manufacture of the sulphuric acid required for the whole of the coke-oven operations, in addition to the acid requirements of the alcohol plant itself.

This completes our statement of the preliminary experimental work, which has satisfied us that we can make cheap alcohol from coal gas on an industrial scale. A number of chemical engineering difficulties present themselves in working out the large-scale process; but there is nothing which is in the least degree insurmountable.

DISCUSSION.

In a humorous introduction, Mr. F. P. WILSON (President of the Institution) remarked that in Middlesbrough they had recovered from coke-oven gas everything except the smell; and if they did not fly to alcohol, there was room for surprise. He thought they must congratulate Cleveland on having in the Skinningrove Iron Company and its Directors (more particularly Mr. Alfred Hutchinson) and the staff pioneers in this excellent work.

Dr. J. E. STEAD described the paper as an epoch-making record of an immense amount of work and a great success obtained by a firm in the Cleveland district. Several points of first-rate importance had arisen in the paper. Mr. Bury had discovered the wonderful properties of sulphuric acid, by which they got 70 p.ct. absorption at between 60° and 80° temperature. This was a wonderful discovery; and he complimented the firm on their progressive spirit. He believed that Skinningrove was the only iron-works where "T.N.T." was produced instead of merely the bye-products.

Mr. HAROLD WRIGHT thought that the paper would cause young chemists to seriously regard the possibilities which lie before them. It would encourage them to take up subjects, investigate them, and follow them up through failure after failure to ultimate success.

Mr. C. H. RIDSDALE applauded the splendid pioneer work of the Skinningrove Company in this matter. The references to the greatest absorption between temperatures of 65° to 85° C. indicated the need for the greatest precision in the working of the process. More and more they found that, if they were to get big-scale production and successful production, it was not simply a matter of brute force, but to a great extent of precision and accuracy in detail work. This was a feature with which chemists were constantly brought into contact; and every day cases arose of trouble through lack of precision. If the working men were going to get better pay, they did not need to work harder, but they must work with greater attention to detail.

Mr. ALFRED HUTCHINSON (Director of the Skinningrove Company) paid tribute to Mr. Bury's important technical research. The extraction of alcohol, as described by Mr. Bury, was a chemical process long known to organic chemists; but Mr. Bury was the first to follow it up and carry it out on a commercial scale. He ventured to predict that the sulphuric acid method of producing alcohol from coke-oven gas was the process of the future. The lesson of this was, "Chemistry, and yet more chemistry." They needed not only more and yet more chemists—trained chemists—but they needed to make chemistry a necessary part of the training of the managers and directors of large concerns, because only the chemically-trained mind could really sympathize with chemical research, without which there could be no true progress.

Forthcoming Census of Production.—The Board of Trade have ordered that a Census of Production in connection with certain specified trades shall be taken in 1921. Returns will not be required from persons, companies, or firms who do not employ on the average more than five persons, exclusive of officers, during 1920, provided that signed declarations are made of the average number employed. Included among the trades of which returns will be required are coal mines under the Coal Mines Regulation Acts, coke works at collieries, oil-shale mines and shale-oil works, iron and steel trades (smelting, rolling, and founding), engineering trades (including electrical engineering), copper, brass, lead, tin, zinc, and other metal trades, chemicals, coal-tar products, fertilizer trade, brick and fire-clay trades, gas undertakings, and electricity undertakings.

MIDLAND JUNIOR GAS ASSOCIATION.

Some Interesting Gas-Furnace Installations.

The second of the "Paperettes" read at the recent meeting of the Midland Junior Gas Association was by Mr. H. R. Hems, who described at length some interesting gas-furnace installations which have come under the supervision of the Birmingham Corporation Gas Department during the last few years. He approached the matter rather from the point of view of the gas suppliers than from that of the actual user of the furnaces.

BRASS MELTING.

Dr. C. M. Walter, in a paper read before the Institute of Metals, gave a summary of working costs for a battery of twelve high-pressure gas-heated melting-furnaces installed in a Birmingham foundry, and dealing with brass in pots of approximately 50 lbs. capacity.

It has been the lot of the author to carry out a series of tests recently on two of the furnaces referred to, owing to a complaint being received as regards the high cost of melting. It was decided that a secondary high-pressure meter should be installed in the foundry and connected to one of the furnaces (no alteration whatever being made to the furnaces themselves), to ascertain the actual gas consumptions during working hours. This was carried out, and a two days' test made on the furnace. The results showed that, on spot readings of the meter taken during every heat of metal melted, the figures obtained approximated 260 c.ft. per hour. The consumption allowed for when the furnaces were first started-up about five years ago was 250 c.ft. This proves the stability of [the high-pressure furnace—making it practically fool-proof as regards handling. The control which is possible is a great feature where a furnace is placed in the hands of an ordinary workman. This battery of furnaces is under one man's supervision; and this, no doubt, has a considerable effect on the question of gas consumption, and particularly on wear and tear of the linings, &c. Some of the original linings are still in use in these furnaces.

DIE CASTING.

A particularly modern application of gas is that of the melting of aluminium for casting into steel dies. There are in Birmingham several foundries which can be properly termed "all-gas" foundries. The alloy used is one consisting principally of copper, aluminium, and zinc; the copper usually being melted in a small quantity, and a little aluminium added. This mixture is then transferrd to a large mixing furnace, usually of the pit type, and having a capacity of 200 to 250 lbs. of alloy; a pot approximately 24 in. deep and 18 in. diameter being necessary where plumbago crucibles are used. These large quantities of alloy are also being melted very successfully in bowl-shaped pots with chamber burners placed beneath them.

A furnace of this size has a gas consumption of approximately 1000 c.ft. per hour, and will bring-down a pot of metal in about two hours. This time could be improved upon; but it is not advisable, as the metal is very likely to be overheated, which is detrimental. The metal from the large furnaces is poured into ingots, and handed to the die-casters for re-heating in their smali "hot pots"—these consisting of special cast-iron pots fixed into a fire-brick setting, and heated by a single chamber burner. One of these furnaces holds up to 50 lbs. of metal, and usually supplies about four dies. The furnaces referred to as being in use in Birmingham are heated by both high-pressure and low-pressure and air-blast systems, and in one or two instances by low-pressure gas with natural draught, though the last mentioned is rather an isolated case, as the rate of heating is very slow.

HARDENING OF PEN-NIBS.

A Birmingham firm applied for a furnace for the hardening of nibs; and a test was arranged with a quantity of work in three different types of furnace—first, in a natural-draught oven furnace with a central system of heating under the bottom slab; secondly, with a natural-draught furnace with the flames playing over the work and under the arch roof of the furnace; and, thirdly, with a furnace similar to the last named with the gas at low pressure and a pre-heated air supply coming from a fan working at a pressure of about 6 in. The results were: (1) Satisfactory work, but slow heating; (2) quicker heating and satisfactory work; (3) speed of working more rapid still.

A quantity of nibs were placed in a circular cast-iron container, about 6 in. diameter and 2 in. deep with three short legs, and a cover for preventing air getting at the work and damaging it; the scale-removing process in this case, as with needles, being a question of many hours of barreling. After getting-up the whole to a temperature of 800° to 1000° C. either way making a difference between burnt and soft work—the pot is taken out, the lid removed, and the contents quenched as speedily as possible in whale oil. The test of satisfactory work to be applied was the fracture of a pen-nib at various parts, and examination of the grain under a fairly powerful magnifier.

An order was placed for a furnace of the last-mentioned type, duly installed in the works, and batches of work put through; very varied results being obtained. The furnace was found to require a large amount of attention to maintain an even temperature; and if left for a short time unattended it had a tendency to mount-up—burning the work. Further, the work at the side, where the flames entered, was nearly always found to be burned whereas in the middle it was very rarely up to a correct temperature. Also, the bottom of the pots of work never received sufficient heat to bring them up uniformly with the tops of the pots. Consequently, after repeated experiments, it was decided that the furnace was useless for this class of work; and it was decided to revert to the first furnace tried on the test—the natural draught furnace, with central burner system of heating. The furnaces were duly exchanged; and the new one, with a few minor alterations, has proved very satisfactory. Further furnaces of a similar type are being installed to take the place of the coal-oven this particular manufacturer is at present using. The question of fuel cost in this case is not so important as convenience and quality of work produced.

In this installation there will be a thermo-couple and indicator connected as a separate instrument to each furnace; and there is being tried on one a special indicator fitted with an alarm attachment, to notify the man in charge of the furnace when a batch of work is ready for quenching.

GLASS.

Birmingham has several large glass works where gas is installed for the annealing operation in "lehrs" of varying capacity, and also for "glory holes" used for the finishing operations after blowing. In one small place there has been running for a good number of years a tank used for the melting of "batch" and "cullet" for the production of a cheap class of scent and sauce bottles, and similar articles.

The furnace is of special design, consisting of a long rectangular brickwork box, divided into three sections. Into the first the glass is fed, and has playing directly upon it two large high-pressure flames which do the preliminary melting operations; the molten-glass flowing underneath the first baffle into the second and third chamber, and from the latter being taken off from two holes by the glass-blowers.

It is never let out, except for Saturday afternoon and Sunday morning, when minor repairs have to be carried out; and it burns approximately 1000 c.ft. per hour. The gas and air supplies need fine adjustment; but this is readily understood, when it is mentioned that the owner and manager of the place are both ladies who are solely responsible for the control of the furnace—the men considering themselves glass-blowers—not furnace operators.

NUT AND BOLT MAKING.

As to high-temperature furnaces for the forging of steel and wrought-iron bars, for nut and bolt making, there are a tremendous number of furnaces used in the Black Country for this work, these being heated by coal, coke, oil, producer gas, and a small number by town gas. There is reason to believe, from experiments which were recently carried out, that in future town gas will come much more to the front in this application.

One particular installation of gas-furnaces for this class of work which has come under our supervision at Birmingham is one applied to the manufacture of nuts and bolts. The furnace was originally a solid-fuel heated furnace; and when it was decided to use gas, the only alterations that had to be carried out were four holes to be cut in the roof of the furnace and four large-size gas-burners to be fitted—the waste gases finding their outlet at the working parts of the furnace and through one hole in the centre of the furnace roof.

No consideration was taken of the size of the combustion space, which was of exceptionally large size. This worked well until the price of gas began to go up, when the users asked if something could not be done to reduce their running costs.

A complete test was carried out over two whole working days on the furnace as it stood. Air-blast burners having 1½-in. outlets were fitted to the furnace; gas being supplied at a pressure of about 22-10ths through a 600-light meter, and air at about 2 lbs. through a 6-in. pipe, from a standard type of rotary compressor. This one furnace had to keep supplied two nut-making machines and three machines for the heading of bolts. In the first-mentioned machine the steel is cut into shape, and a hole cored in the centre according to the thread required, at two operations; and in the second machine a severing operation practically takes place on the blow being applied to the steel piece. The head is formed, and the heat has to be sufficient to cause the welding of the two pieces together again.

The furnace was lit up twenty minutes before the men were required to start work; and a gas consumption of approximately 3500 c.ft. per hour was maintained over the whole day. A total of 2¼ tons of work was produced from the furnace on the first day's run; and on the second the total came to about 1 ton 17 cwt. Over the two days' test a gas consumption of approximately 15,000 c.ft. per ton of work produced was required, which, with gas at 2s. 8d. per 1000 c.ft., less 5 p.ct. (the price prevailing at the time of the test), works out at about £2 per ton.

After a thorough examination of the furnace, it was decided that considerable economies could be effected; and the first alterations to be made were to the combustion chamber. This was reduced to practically half its size, and a considerable saving effected in gas consumption. Attention was then turned to the air and gas supplies. The latter could not be improved in any way; but the former on this particular furnace was scrapped, and a more up-to-date compressor installed from which a greater pressure was obtained. When this was got to work, it was possible to burn a greater amount of gas in the reduced combustion space; and consequently a much higher temperature was obtained,

resulting in a greatly increased output. Though the gas consumption remains practically as before, the output has increased considerably, and men are not kept standing idle owing to "cold" furnace.

Tremendous gas consumptions are to be obtained from the forge shops of the Black Country when the right type of furnace is produced. There is reason to believe that things are moving in the right direction, and that before long there will be a town-gas furnace which will compete very favourably when all points are taken into consideration with solid fuel, oil, or producer-gas furnaces, even on a fuel cost basis. For instance, there is a forge designed on the "Revergen" principle by the Davis Furnace Company, with regenerative settings acting alternately as air carriers and waste-gas flues, whereby high working temperatures are maintained with low gas consumptions. From tests recently carried out, there is reason to believe that the figures of gas consumption given for the direct-fired furnace can be reduced by approximately 33⅓ p.ct. on the same output being maintained; and if this proves to be the case, there is no reason why town-gas forges should not be installed in many large-scale works that at present use solid fuel and oil.

ENAMELLING.

The term enamelling includes many branches, from the enamelling of jewellery and meter and clock dials, to large enamelled signs. The jeweller, of course, still uses the "muffle" furnace originally supplied to him by Fletcher; and there is no doubt that a tremendous amount of work has been done satisfactorily in this type of furnace. The reason for the wide use of the closed-in furnace, as distinct from the open type of oven, in this application is the keeping away of the products of combustion from the enamel.

The Birmingham Corporation recently received an inquiry for furnaces for enamelling, and carried out a number of tests on various standard types with white enamel on metal plates. A temperature of about 900° C. was required to be maintained in the furnace, with a fairly frequent door opening. After several experiments, an air-blast oven was tried; and it was found that, so long as an oxidizing atmosphere was maintained in the oven, the work could be produced satisfactorily, from the point of view of colour, at a very quick rate—the danger in this case being the risk of burning if work was left in the furnace too long.

JEWELLERS.

In jewellers' workshops, furnaces are used for the production of sheet gold and silver. The furnace for melting is of the type already mentioned, but much smaller; in many cases crucibles capable of holding only 20 or 30 oz. of gold being used. After pouring into ingot, the metal has to be rolled; and it is necessary to anneal between each rolling. This is generally carried out by means of a blow-pipe flame, played on to the metal. Considerable loss is caused by this method; and where natural draught muffle-furnaces have been installed, much better working has resulted. Birmingham, of course, is richly endowed with jewellers, and a large field presents itself; but similar small installations must be needed in many other parts of the country.

TUBE BRAZING.

Another operation to which considerable attention has been paid is that of the brazing of tubes. This work has always been carried out by very skilled operators, who have led one to believe that the "skill" was in the arrangement of the fire, which in almost every case consists of small coal fire working with slight air-blast. From a series of tests the Corporation carried out, there is no doubt that the gas-furnace is far more efficient and satisfactory in its working than the old type of furnace. The actual fuel cost is undoubtedly higher in the case of continuously working furnaces; but many are required only intermittently, and where this is so gas certainly scores. Again, there is no skilled labour required; and the heat can be adjusted to such an extent that on production the tubes can be fed into and out of the furnace on a time basis.

There are one or two furnaces working very successfully in Birmingham on small tube work; and it is hoped shortly to equip a large works making bedstead tubes of all sizes (from 5 in. to 2 and 2½ in.) with gas-furnaces, though before actually proceeding with this installation, probably further experiments will be made with a furnace of the "white flame" type, as this will be more in line with the older method, and there will be less risk of the blowing-away of the solder.

SOLDERING.

Gas-heated soldering-iron stoves, though small, are so often required in such large quantities that they are certainly worth close attention by any gas undertaking. The ordinary type of low-pressure stove is a very inefficient form of apparatus, but serves its purpose where an odd stove is required. Low-pressure gas is also used on the brick stoves very successfully, provided a good supply of gas is available.

By far the best system of heating is by means of gas at a pressure of about 5 lbs. per sq. in., with a suitably designed stove; and in Birmingham there are many working, both from a governed supply from the high-pressure mains and also with small rotary compressors. When working with the latter, it has been found advisable to divide a large number of stoves into batches; a separate compressor being used to supply each batch.

[A number of lantern slides were shown during the reading of the "Paperette."]

DISCUSSION.

Mr. B. J. BELL (Birmingham) paid tribute to the original work on high-pressure gas-furnaces done by Dr. Walter at the Municipal Research Laboratories. In a city like Birmingham, it was important to pay attention to gas consumption as regarded gas-furnace work. He emphasized the need for co-operation between large and small undertakings in order adequately to advise consumers. Again, the question of the personal comfort of the workmen was important.

Mr. BATT, referring to tinman's stoves, which he said were selling extremely well, observed that the gas-heated type was not so suitable as the old charcoal stoves as regarded the effect on the copper end of the soldering iron unless special steps were taken to protect it.

Mr. A. H. MILLS said he had had experience in the melting of metal, and particularly brass, in large quantities. He considered Mr. Hem's figures for gas consumption were high, and the times rather long. As to furnaces for annealing processes, he asked if coal-gas furnaces were much in use for this purpose.

Mr. DEAN asked as to the merits and demerits of air-blast as opposed to high-pressure gas.

The CHAIRMAN commented upon the extremely useful work carried out by the Industrial Research Laboratory, and suggested that information as regarded electric-furnaces would have been useful.

Mr. HEMS, replying on the discussion, pointed out that Dr. Walter's work on this subject was well known. The work in Birmingham was extremely varied, as it covered a tremendous number of trades. He agreed as to the need for co-operative effort, and thought that some institution like the "B.C.G.A." might take the matter up, and offer help and advice in industrial heating matters. Employers were fully alive to the need for studying comfort in factory working. The conditions in some works where the furnaces were not gas-fired were extremely bad. In regard to tinman's stoves, manufacturers were now taking special measures to protect the soldering irons by means of a fire-brick shield. He had not had much experience in relation to the larger types of furnaces, as the majority of installations he knew concerned the supply of metal to sand castings. Furnaces for annealing processes mostly had their own gas-producers, and coal gas would probably not be so efficient. The great point affecting the use of coal gas in furnaces at the present time with some manufacturers was the disposal of clinker, &c., and the difficulty of obtaining fuel. As regarded high-pressure gas and air blast, high-pressure gas was much more convenient, as there was only one tap to turn on, and practically no regulation was required on the part of the workmen. The action on the lining of furnaces was not so great as in the case of air-blast. As to electric heated furnaces, current would have to come down in price considerably for such types to be generally adopted; but for smaller and delicate operations particularly, the type was applicable in a small number of cases.

Dr. C. M. WALTER (Industrial Research Laboratories, Birmingham) moved a vote of thanks to Mr. Hems. The subject discussed was one which must receive more attention from gas concerns in the future. He thought it could be rightly shown that they in Birmingham had to do much of such work having regard to the great diversity of industry. He was afraid, however, that other gas concerns were not doing as much as they might with regard to the sales of gas for manufacturing purposes. It behoved every gas concern which desired to develop sales of gas for manufacturing purposes not only to make itself acquainted with the various designs of furnaces, but to be prepared to design special furnaces for special needs. Gas concerns should be thoroughly conversant with the requirements of the various trades and manufactures within their area. Mr. Hems had referred to the work in connection with a nut and bolt furnace. In the Black Country was a huge area which was undeveloped to a great extent so far as gas fuel was concerned, with the exception of producer gas; and he was sure that when more attention was given to the matter there would be a huge consumption from this particular area. The work already done showed the huge potentialities in an industrial city like Birmingham.

Mr. V. E. GREEN seconded the resolution, and testified to the amount of practical research work done in the municipal laboratories by Dr. Walter and his assistants. This work was unquestionably doing much to promote the sale of gas, though this was not the primary object. The policy of making experiments on behalf of the industrial community had been amply justified. The more a place offered such facilities the greater its attractiveness to manufacturers.

The vote was duly passed.

American Gas-Works Practice.—The Progressive Age Publishing Company, of No. 52, Vanderbilt Avenue, New York, forward a copy (which early opportunity will be taken to review) of one of the Gas Age Handbook Series—"American Gas-Works Practice," by George Wehrle. It is the fourth of this series of handbooks on subjects pertaining to the gas industry, and deals with standard practical methods in gas-fitting, distribution, and works management—the idea being to provide a reference book covering in a general way the entire field of American gas-works practice, and specializing in a number of chapters on gas-fitting work. In a preface, Mr. J. D. Shattuck says the book offers a popular route for advancement to the gas employee. The 700 and more pages contain some 400 illustrations.

A Book on Industrial Gases.—Pending publication of a fuller notice, acknowledgment is made of the receipt from Messrs. Baillière, Tindall, and Cox, of No. 8, Henrietta Street, Covent Garden, of a copy of "Industrial Gases," by Harold C. Greenwood, O.B.E., D.Sc. (Manchester), F.I.C., the price of which is 12s. 6d. net. The main aims of the book are to give a general account of the manufacture and technical manipulation of gases, to describe briefly the development and general principles of industrial gas technology, and to present a collection of data likely to be useful in connection with such technology. It is one of a series of volumes giving a comprehensive survey of the chemical industries, edited by Samuel Rideal, D.Sc. Lond., F.I.C., who is being assisted by a large number of other well-known chemists,

COKE-OVEN MANAGERS' ASSOCIATION.

(Midland Section.)

A Meeting of the Midland Section of the Coke-Oven Managers' Association was held last Saturday week, at the Grand Hotel, Sheffield—Mr. J. A. DAVY, of Crigglestone, in the chair.

GENERAL BUSINESS.

At a special meeting of associates, preceding the general assembly, Messrs. W. Green (Manvers Main) and F. White (Parkgate) were elected to represent the Associates on the Midland Committee for the year 1920, and Mr. Green was appointed the Midland Associates' representative on the General Council of the Association. The meeting resolved to send a vote of sympathy to Mr. John W. Lee, the President of the Association, who had undergone an operation.

AN ALTERATION IN THE PROGRAMME.

The HON. SECRETARY (Mr. Gerald H. Lant) drew attention to an alteration in the programme for March and April. At the last recent meeting it had been arranged that Mr. J. T. Price's paper, originally promised for April, should be given in March, so that the April meeting should be a visit to the Harland plant at Chesterfield as well as a paper by Mr. J. W. Lee. Unfortunately, Mr. Price found himself unable to get his paper out for March; and so the Committee had agreed for the papers to be as originally planned—Mr. Lee's on March 27 at Chesterfield, and Mr. Price's on April 24 at Sheffield.

It was stated that the January meeting would be at Sheffield, when an address would be given by Mr. Reece, of the University.

The CHAIRMAN appealed to members to get their questions for the February question meeting in the hands of the Secretary in good time, so that he could have them printed and issued to all members.

SOME TECHNICAL PROBLEMS.

Mr. T. B. SMITH (Stockbridge) then delivered his paper on "Some Technical Problems of the Future." The communication appeared in the "JOURNAL" last week (p. 660); and the following is a report of the discussion to which it gave rise.

The CHAIRMAN said he wondered whether Mr. Smith had had any practical experience of working ovens on producer gas. The author had said he thought there would not be much difficulty in working them through the present batteries—present built batteries—of ovens. Personally, he thought it would be found that a specially built battery was necessary. Mr. Smith had said nothing about tar extraction in producer-gas plant; but he (Mr. Davy) supposed it would be there.

Mr. SMITH: That is so.

Mr. RILEY said 5-10ths of an inch seemed rather low pressure on which to work a battery of ovens. With regard to using producer gas on an oven which had been built to work with the rich gas, at Tinsley Park they looked into this question a couple of years ago, and were advised by the designers of the special battery that it was utterly impossible to do so.

Mr. HADFIELD asked whether £3000 would be the cost of the plant at the present time.

Mr. J. T. PRICE said the author was in a position to speak from considerable practical experience, having had a lot to do with producers practically before he had to do with coke-ovens. He agreed with Mr. Smith as to the introduction of gas-producers in connection with coke-ovens. He had himself often been surprised to note the large quantities of low-grade fuel lying about collieries, and no attempt made to use it. Perhaps the question of gas-producers was more concerned with people who were selling the gas or using it on other parts of the plant. On his own place they employed it for smelting steel ingots. He could not see why the producers should not be adopted on the coke-oven side of the plant. At his place, they had put down a large number of producers on the soaking side. He thought they ought to be on the coke-oven side of the plant, and so liberate the whole of the gas for the soaking pits or mixers as the case might be. The same thing applied when they were selling gas. It was a crying shame that the large quantity of low-grade fuel about the collieries should lie unused while gas of high calorific value should be employed for bringing up the temperature of the flues. A man to whom he was speaking recently—a man who had studied the plants in Germany—assured him that the action of the producer gas on the regenerators was very high. He (Mr. Price) agreed with the previous speakers in saying that it was all right so far as the tuyeres were concerned; but he understood that there must be an alteration of the flues, and that, as at present designed, they would not deal with producer gas. This was the advice given him by coke-oven erectors.

Mr. W. GREEN asked, with reference to the washing of the dust out of the producer gas, if Mr. Smith could give any figures as to what yield of potash he might have found in the dust. They knew that, during the war, dust-cleaning processes on blast-furnaces had yielded a large quantity of potash. Did the sulphate produced consist solely of ammonium sulphate, or were there other impurities—sulphides, for instance—in the sulphate? What was the final result on the finished salt? With regard to the working of producers on low-grade fuel, he wondered how a good bituminous coal would do in gas-producers? They had heard it said that it was all right; but he had also heard it stated that it was not always so easy as it seemed. How successfully did they work with a high percentage of ash? He knew of one plant which tried low-grade fuel, and it was not a success. Regarding the question of the producer gas in the flues, he asked whether it would be necessary to heat-up the producer gas before applying it to the ovens. He thought the supply of producer gas to ovens would be a fine system if it could be adopted as the method of heating. It might be better placed with more general application to the future. It had been successfully carried out at the Birmingham Gas-Works for some years; and it was only wanting general application. They had results in Germany with both producer and blast-furnace gas, and also in America. They had not much information as to the class of fuel used in the producers.

The CHAIRMAN remarked that if they were to consider 30 p.ct. of ash as meaning an inferior fuel, there would not be many coke-ovens working in South Yorkshire and Derbyshire. They practically lived on this, especially in these times. There was nothing lying about the collieries, as Mr. Price had mentioned, which would have 30 p.ct. of ash.

Mr. GREEN said on the producer plant he mentioned they worked with 50 p.ct. of ash; but they could not make it a success.

Mr. FLEMING said the author stated that in the dust washer no ammonia was absorbed owing to the high temperature of the gas passing through. Would Mr. Smith say the temperature attained at the exit of the producers as a general rule in practice? He knew it was pretty high. Of course, they had the question of tar extraction from the producer gas. He expected Mr. Smith would reply to this. With regard to pitch, the author had said his test showed that part of the condensed volatile matter was found to be suitable for tub and wagon grease. Would he say what part, and how much, was found suitable, and what happened to the remainder which was not suitable?

Mr. B. W. HAIGH said that to use producer gas successfully on coke-ovens it needed a double set of regenerators—one for heating the gas and one for heating the air. This was what they had always worked upon. If Mr. Smith could tell them of something different, they would be glad to hear it. As to pitch, his firm were asked, during the war, if they could make pitch coke in their beehive ovens. They went to inspect a plant where it was being done successfully, in that the quality of the article produced was very high; but the conditions under which it was made were really very difficult. He did not think it was a commercial proposition, apart from war purposes.

The CHAIRMAN: I wonder if Mr. Haigh knows the price he could get for pitch coke, when he says it is not a commercial success?

Mr. HAIGH: I forget the exact figure; but I think it was not sufficient.

The CHAIRMAN said the best use of pitch during the war that he had seen was the mixing of it with oil as a fuel oil. Many thousands of tons of it were used in this manner to Admiralty specifications. They obtained their liquid fuel then.

Mr. SMITH, replying to the discussion, said, on the question whether the existing type of ovens could be worked with producer gas, he would like to say that the plant which he had in mind in the paper, and which had worked successfully, was a low-temperature plant at Barugh—horizontal flues, and of the recuperative type. The producer gas there could get quite an ordinary high carbonizing temperature. This was not what they had wanted; but it was what they got. It required no heating-up of the producer gas at all. There was some tar made. It was only a very small quantity, however, and should not really be called tar, but rather pitch. If a producer plant were put in connection with coke-oven plants, he thought the pitch could easily be fused in the tar which came from the ovens. It was terrible stuff to distil, and even then about 50 p.ct. remained after one had done one's best. Mixed with ordinary tar, it was quite easy to distil. Mr. Riley had questioned the 5-10ths of an inch pressure. At the present time he was working his battery with 3-10th of an inch. He admitted that this might not be considered as a comparison, because he believed he was the only man in the meeting who was carbonizing dry coke. He had merely taken it as an example. As to whether £3000 would cover the cost to-day, he knew it cost £2000 to put up a plant at the beginning of the war for one producer. At any rate, the cost would not be less than the figure he had quoted.

The CHAIRMAN: I think you should multiply by three in these days, as against pre-war prices.

Mr. SMITH said the balance-sheet in the paper showed 15 p.ct. for depreciation and interest on £3000. If they doubled the capital outlay, the item would come under £2 10s. The main item was the cost of the coal. He agreed with Mr. Price's suggestion that producers used for the smelting of steel should be on the coke-oven side, and that the ammonia—considering there was a yield of 80 lbs. per ton of coal carbonized—should be extracted. He had put the position to steel men, and had recently put it before his own people. Their chemist had made inquiries and found that they used the gas directly from the producers at a temperature of from 300° to 400° C., and the specific heat, reckoned in £ s. d., was considered more valuable than the ammonia recovered. They reckoned that the calorific value they obtained in the furnaces was so reduced that it would not pay to recover the ammonia. He was sorry he could not answer Mr. Green's question as to potash. The sulphate of ammonia was greyish in appearance; but there was very little difficulty in meeting the ordinary specifications provided that the absorbers were kept acid and not allowed to get alkali. As to the high ash and the low-grade fuel, the firm with whom he was engaged at the time had told him that they were able to guarantee 60 p.ct. of ash. There were various mechanical ash ejectors, Mond, Trump, Berkerly, Crossley, and others—which worked up to the 30 p.ct. he had given; but it did not do to listen to makers' guarantees when they talked about such figures as 60 p.ct. Another point with regard to the high percentage of ash, the matter depended largely upon what one was out to make. He believed there was a plant in South Africa which would work 60 p.ct. of ash; but they were not out for making gas, but sulphate of ammonia. The percentage of the latter depended upon the amount of steam put into the producer; and the more sulphate of ammonia one made, the lower would be the calorific value of the gas. The quantity of steam used really controlled the amount of ash that could be used successfully in the producer. Mr. Fleming asked the temperature of the gas in the producer. This also depended on the amount of steam. It might vary from 200° to 300° C. As to the grease, on distillation the first half of the pitch was a lubricant, and the second half was very tacky, almost like gum. In answer to Mr. Haigh, he thought what he had said about horizontal recuperators covered his point. As to pitch coke, he understood the Ministry of Munitions had experimented on a beehive plant in Durham. He had had a sample of the residue, and he fancied his assistants in the laboratory had a very rough time with it. They obtained about 10 p.ct. of ash. Although Mr. Haigh spoke of extreme difficulty, was not the same difficulty experienced in distilling petroleum residue? Yet it was overcome. Why not adopt the same kind of plant which was used in making petroleum pitch?

Mr. LANT said, with reference to the pitch question, he had visited a Ministry of Munitions beehive pitch plant in South Yorkshire, and the coal was charged into the beehives in a very similar way to what they did it on the coke-oven principle. Trouble developed if the pitch began to boil over; but they had appliances at hand for stopping this, though he believed they had had a good deal of trouble with it at first. They obtained a splendid coke, which was used for aluminium melting for aeroplane parts.

Mr. T. LONG said he had been making pitch in beehive ovens in earthenware pipes.

The CHAIRMAN thought that in the old days there was quite an industry in making pitch coke. He had been approached by some old tar distillers to put in plant for making pitch coke. On the question of the low-temperature plant at Barugh, he thought one would hardly call this a coke-oven plant.

Mr. SMITH said it could produce metallurgical coke as in any coke-oven. He had had as much as 12° C. in the oven there. Producer gas was used in smelting steel on his own plant.

The CHAIRMAN remarked that at the Skinningrove works for years they had been using coke-oven gas mixed with blast-furnace gas, and just mixing a certain quantity to get the absolute calorific value required for both the gas-engines and the soaking pits, &c.

Mr. PRICE said his firm adopted the same principle. They were using the producer gas *plus* the coke-oven gas. His contention was that the coking plant should use the coke-oven gas and the works should use the producer gas with blast-furnace gas.

The CHAIRMAN said that from the builders' point of view it was an absolute necessity to have it preheated and regenerated, the same as the air. There were ovens building in the country with this object in view.

Mr. SMITH believed Messrs. Simon-Carves had built four ovens for producer gas, and they were, he understood, quite successful.

On the motion of Mr. PRICE, seconded by Mr. BISHOP, a hearty vote of thanks was awarded Mr. Smith.

A Study of Gases.

Among those who addressed the American Gas Association at the annual convention was Mr. Henry L. Doherty; and one of the questions considered by him was that of the most satisfactory gas to supply. For some reason, he said, it always seemed revolutionary to gas men to talk about serving a non-luminous gas, and particularly to talk about a gas containing no hydrocarbons. At one period, he spent a great deal of time and money on investigating the possibility of producing on a commercial scale marsh gas from carbon monoxide and hydrogen. When engaged on this problem, he became convinced that he could serve, not only a cheaper, but also a better, gas (when considered in the aspect of all its uses), if it contained no hydrocarbons. But this is a problem he would like to see broadly discussed. If the gas business were developed to a high degree of efficiency, he is inclined to think that, even with room-heaters, it would be found that the greatest efficiency would be secured by the use of recuperators, and that practically all industrial appliances would be equipped with either recuperators or regenerators. Hydrocarbons are objectionable on account of breaking-down during the pre-heating process, and depositing carbon either in the regenerators or elsewhere. At this stage of his investigation, he is rather of the opinion that the most satisfactory gas of any now available would be a blue water gas, except for its large content of carbon monoxide. Certainly, a gas containing largely hydrogen would prove a much more satisfactory gas than the public now obtain. It is far from true that the quantity of gas is fixed by its "B.Th.U. density"—that gas having the greatest number of B.Th.U. per cubic foot is the best gas. Marsh gas having about 1000 B.Th.U. per cubic foot has a much lower flame-temperature than either hydrogen or carbon monoxide, though these gases run in the neighbourhood of 300 B.Th.U. per cubic foot. Marsh gas also has such a low rate of flame-propagation that it cannot be used for some purposes. Taking 16 lbs. of marsh gas containing 4 lbs. of hydrogen and 12 lbs. of carbon, it would only produce on combustion about 90 p.ct. as many B.Th.U. as if one were to burn 4 lbs. of hydrogen gas and 12 lbs. of solid carbon. The only place where marsh gas is more desirable than, for instance, a blue water gas is in an internal combustion engine where the Otto or some similar cycle is used, and the gas and air are mixed during the compression stroke.

A Bibliography of Petroleum.—The United States Bureau of Mines have issued, as Bulletin No. 165, a "Bibliography of Petroleum and Allied Substances in 1916," by Mr. E. H. Burroughs. It follows the same general scheme as the bibliography for the previous year, though a few minor changes have been made in the scheme of classification.

A New Heat-Meter.—The "Technical Review" draws attention to a description in the "Gesundheits Ingenieur" of a heat-meter introduced by Mr. Hans Henrichsen, of Hellerup, Denmark, for use in connection with central heating installations. Meters of this type were found eminently satisfactory in actual use last winter; careful trials having shown an error which was frequently substantially less than 5 p.ct. The meter consists of three thermo-electric couples in boxes, two of which are attached to the radiator, and the third fixed on the wall of the heated room. The heat difference between the radiator and the wall produces a feeble electric current which is recorded by integrating mechanism; the radiators from each consumer being connected in series to the integrating meter.

TAR-OILS FOR ENGINES.

In a paper read before the Institution of Petroleum Technologists, on the "Application of Liquid Fuel to Heavy-Oil Engines," Mr. A. J. WILSON said that some tar-oils are more apt to choke the fuel valve pulverizers than others; and experience has shown that a good guide to the suitability of a tar-oil fuel for Diesel-engine use is the percentage which is insoluble in xylol. This percentage would include the free carbon and any foreign matter picked up by the passage of the oil through the distilling plant. It is interesting to note that one Company, in their specification for tar oil, limited this insoluble matter to 0·2 p.ct. This question of what is, or what is not, a suitable tar-oil for Diesel-engine purposes has engaged the attention of the Diesel Engine Users' Association for some years past. The specification used by the National Fuel Oil Company is:

Specific gravity at 20° C.	Below	1·10
Flash-point (open)	Above	150° Fahr.
Coke	Below	3·00 p.ct.
Ash	,,	0·05 ,,
Matter insoluble in benzene	,,	0·25 ,,
Total water by volume	,,	1·5 ,,
Separated water		*Nil.*

This represents a safe average class of fuel which experience has shown to give excellent results in practice.

Creosote oils—distillates of coal tar—vary considerably in their characteristics; the wide differences met with being primarily due to: (1) The kind of coal from which the tar was derived, and (2) the process and plant used in carbonizing the coal.

The two chief sources of the tars are the gas industry and metallurgical coke plants or coke-ovens. On the one hand, we have a product of coal carbonization with the maximum production of illuminating gas as the main object, and on the other the chief aim is the production of a heavy coke or smokeless fuel. The tar is regarded merely as a bye-product from these industries; and no particular pains are taken to produce either the maximum quantity, or to render it suitable for distillation as a fuel for Diesel engines.

Horizontal retorts are very largely used in the British gas-making industry, and do not produce so satisfactory a tar as vertical retorts, from the point of view of distillation of suitable tar-oils for Diesel-engine use. The tars from vertical retorts contain less free carbon, less naphthalene, and rather more hydrogen. As a result, the vertical-retort tars contain more aliphatic hydrocarbons; and combustion should therefore be easier than in the case where a large proportion of the hydrocarbons are of the aromatic or closed-chain structure.

The chief outstanding feature of the tar or creosote oils is their high spontaneous ignition point compared with petroleum fuels, as the table given below will indicate.

Fuel.	Specific Gravity.	Spontaneous Ignition Temperature.	
		In Oxygen.	In Air.
Crude petroleum (Texas)	0·936	268·5° C.	416° C.
Anglo-Mexican fuel-oil	0·908	259·5° C.	417° C.
Creosote oil (Hardman and Holden)	1·010	415·0° C.	—
Coke-oven tar-oil (Simon-Carves)	1·046	478·0° C.	—

A typical analysis of a horizontal retort tar-oil is given:

Specific gravity	1·049 at 20° C.
Closed flash point (Gray)	200° Fahr.
Water	0·60 p.ct.
Coke	None.
Ash	Traces.
Sulphur	0·68 p.ct.
Hydrogen	7·4 ,,
Tar acids	14 ,,
Gross calorific value	16,544 B.Th.U.
Net	15,863 ,,

Raw tars when heated can be used as a Diesel-engine fuel with some measure of success; but the chief trouble associated with the use of coal gas raw tars lies in the free carbon, the water, and the ash-contents. Here, again, the vertical retort tars have demonstrated their superiority. A free-carbon content of higher than 4 p.ct. begins to present difficulties, but 6 p.ct. may be taken as the limit for internal-combustion engine work. Since the horizontal retort tars contain from 20 to 30 p.ct, of free carbon, the use of such tars is not practicable in Diesel engines.

Tars and tar-oils distilled from lignite, however, present quite a different proposition; and this appears to have been very early recognized in Germany. Lignite oils are perfectly satisfactory in any Diesel engine which will run on a petroleum gas-oil, and no special apparatus is required as in the case of coal-tar oils. The vast extent of the lignite deposits in Germany can be gathered from the fact that in Saxony alone a million tons are retorted per annum, giving a yield of 60,000 tons of crude oil, having a specific gravity of ·880 to ·900. The deposits of lignite in Great Britain as proved up to date are not very extensive; the best-known occurrence being at Bovey Tracey, in Devonshire.

REVIVIFICATION OF OXIDE IN SITU.

By O. B. EVANS, of Philadelphia.

[A Paper read at the Annual Convention of the American Gas Association.]

For a good many years it has been common practice to mix a small quantity of air with the gas at the inlet of the purifiers, for the purpose of continuous revivification of the oxide. According to the generally accepted reactions occurring in the purification of gas and the revivification of oxide, slightly less than 0·4 p.ct. of air will, theoretically, be required for the continuous purification of coal gas containing 100 grains of hydrogen sulphide per 100 c.ft. Common practice admits from 0·75 to 2 p.ct.; and it would seem as though this amount should be sufficient to take care of the usual discrepancy between theory and practice, though actually it does not. On the face of it, the best method of procedure for gas plants operating upon a calorific basis would appear to be to increase the quantity of air until continuous revivification does occur. In the case of plants still working on a candle power standard, this would be objectionable on account of the serious reduction in candle power produced by relatively small percentages of air or nitrogen. Unfortunately, however, as Mr. B. E. Cholier has pointed out, it is possible that revivification of iron oxide will not take place in the presence of hydrogen sulphide; and from this theory he has evolved the method of admitting clean gas mixed with air to the fouled box—the subject-matter of a United States patent.

It would seem but one step from the continuous revivification of oxide to the intermittent method, in which the box is put out of gas service, and a large volume of air blown through the oxide mass. This system has been in successful use for many years in several places. In others it has been tried and abandoned on account of the tendency to cause fire.

In order to show the progress being made by revivification in place, and the local conditions existing in plants in which it is operated, a questionnaire was sent to 54 of the larger gas companies throughout the country. Replies have been received from less than 50 p.ct.

The main portion of the questionnaire is given in tables in an appendix; and detailed descriptions of the methods used in some of the plants accompany these.

From information obtained from the questionnaire, and from experiments made in Philadelphia, the following are believed to be the facts regarding revivification *in situ*:

1.—It has been in successful use for over 25 years.

2.—Its use is becoming more general. On the Pacific Coast it has been common practice for many years.

3.—The difficulties met with are caused by channelling and consequent local excessive heating.

4.—The outlet temperature of the products leaving the box is not necessarily an indication of the maximum temperature within the box.

5.—With ample purification capacity and frequent revivification, the oxide never becomes very foul. The quantity of heat to be dissipated at any one time is relatively small. The heat capacity of the bed itself is often sufficient to absorb it. Under such conditions, revivification *in situ* is a very simple matter.

6.—With a small purifying capacity, the quantity of sulphur absorbed between revivifications is large, and the heat to be dissipated is correspondingly great; so that revivification *in situ*, with small purifying capacity, may be unsuccessful, unless extreme care is used.

7.—Shallow boxes aid considerably in successful revivification *in situ*, because of the increased radiating capacity of the box per bushel of oxide. A rectangular box containing 6 ft. of oxide will have only approximately 20 p.ct. more radiating surface than one of similar cross-section but containing only half as much oxide.

8.—With moist beds, there is less danger from firing than from dry beds.

9.—It is not believed that the spraying of water over the surface of a bed is an effective means of preventing fires, because of the difficulty, not only of getting a uniform distribution of water, but of getting it to the centre of the bed, where most needed.

10.—The use of steam as a diluent is a simple method of retarding the reaction, though the increase in temperature brought about by its use would seem to be undesirable. Steam may, by its presence, physically retard the reaction between iron sulphide and oxygen. It is not thought to be as desirable a diluent as an inert gas.

11.—Short blowing periods with undiluted, or nearly undiluted, air, at frequent intervals, will result in a great absorption of heat by the bed itself, though the products leaving the bed may not increase much in temperature. The stored heat can later be carried away gradually by the illuminating gas, and through radiation. This method is in successful use in several places. A uniform rise in the temperature of the bed of 50° should absorb all heat ordinarily liberated, if revivification is done at frequent intervals. The only difficulty to be expected would be from excessive local heating.

12.—The best method of revivifying *in situ* would seem to be the circulation of gases through a cooler, with means for controlling the quantity of oxygen in the mixture. While much of the heat liberated in the revivification reaction is dissipated by radiation from the box itself, nevertheless the cooler is advantageous in that it will reduce the temperature of the products at a critical time, and will deliver a mixture saturated with water vapour. It should be of the contact type (in which the water comes in direct contact with the gas), and on the counter-flow principle. The blower should be of ample capacity to reduce the channelling effect, and should be capable of blowing the mixture through the bed at a rate greater than the gas rate through the same bed. The method of sucking or blowing down through the bed seems to be preferable to the up-flow. With a given inlet area, there should be no difference between blowing or sucking through a bed. Under certain conditions, the latter may be preferable.

13.—The ideal system of purification and revivification would seem to be one in which the gas is cooled, and as much as possible of the tar fog removed. Water would be added to the gas by heating with direct steam to such a temperature that in passing through the purifying system the gas would cool-off and deposit this water throughout the oxide mass. The quantity of water deposited in any portion of the bed would, in general, be in proportion to the flow of gas, and consequently almost in direct proportion to the amount of sulphur removed by that particular portion of the oxide. For this reason, there should be no danger of local heating during revivification. Revivification should be *in situ* by the system described under No. 12. Since the gas would be freed from tar-fog before heating, there would be no tendency to deposit tar-fog in the purifying material.

In the tables, the works are referred to by number; and a letter indicates to which particular number the notes which follow the tables refer. One of the notes consists of the subjoined extracts from a letter from Mr. E. C. Jones, of San Francisco: The comparatively small capacity of purifiers required for our plants in California is probably due to two reasons. First, the framing of contracts for oil from which our gas is made, so that the oil does not contain more than 1 p.ct. of sulphur. Second, more than ample scrubbing capacity, using salt water, when available, in such quantities as would be considered excessive in the east.

I find that this removes a considerable amount of hydrogen sulphide, and relieves the purifiers. It might also be mentioned that the careful preparation of the copperas oxide and close attention to revivification keep down the cost capacity. The Jones purifiers at the Potrero and other plants are 9 ft. high, and originally carried a bed of 5 ft. of oxide; but this has gradually been reduced to 2 ft., and 7 ft. of the box is vacant.

Back in the nineties, New England gas men attempted to revive oxide by blowing air through it; and it was some time in 1889 or 1890 that Mr. Waldo A. Learned, the Superintendent of the Newton and Watertown Gas Light Company, discovered that air should be *drawn* through an oxide purifier containing spent oxide, using either a steam jet or rotary exhauster attached to a suction-pipe at the centre of the bottom of the purifier. He found that, by using this method, all danger of fire or over-heating was overcome. He never patented his invention, nor did he give it the publicity which it warranted. But giving him due credit for it, I installed his system at Charlestown (Mass.) very successfully, in 1890, for the late Mr. Geo. B. Neal; and after coming to California, I introduced it into the works of the San Francisco Gas Light Company, and from there it found its way into nearly every gas-works in California.

The theory is extremely simple. When air is forced against a bed of oxide, the oxide revives locally with a rapid rise in temperature, which usually results in a fire. If air is drawn downward through the oxide, and out through a pipe at the centre of the bottom of the box, the space immediately under the trays is under practically an equal suction, with the result that air is drawn downward uniformly through the bed of oxide, thus reviving every part of the oxide at once; and a rise in temperature which might endanger the oxide may be overcome by increasing the amount of air—thus using a portion of the air for revivifying, and the rest of it for carrying away the heat generated.

I have tried for thirty years to make others understand this principle; and invariably I have found that they have resorted to the method of blowing air through oxide, which I have never dared to do. The only reason Mr. Learned's method has been successful in California is because I have installed it myself, and controlled its operations.

This method has been in use in California for 28 years, without a fire or a case of over-heating; and it has reduced the cost of purification to a point which is almost negligible. In fact, at our Sacramento Gas-Works, for two years, the purification account was on the credit side. This system of reviving oxide is so successful and inexpensive that there hardly seems to be an excuse for a gas-works with ample purifying capacity introducing air in the gas in amounts from 1½ to 2½ p.ct. for continuous purification.

Stoke Street Lighting Complaints.—At a meeting of the Stoke-on-Trent Council, Alderman W. W. Dobson referred to some complaints that had been made against the Street Lighting Committee in regard to their arrangements. He pointed out that, as compared with normal times, the percentages of lighted street lamps in the various pottery towns were: Burslem 50·53, Fenton 55·2, Longton 54·28, Stoke 52, Dunstall 50·8, Hanley 66·24. The cause of the high percentage in Hanley was the large number of electric lamps compared with the other towns. They still had to contend with very serious difficulties in connection with the obtaining of skilled labour and the securing of sufficient supplies of coal and other material. The Gas Committee found that the coal supplies had been so inadequate that there would be difficulty in carrying on through the winter.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Coal Prices and the Gas Sliding-Scale.

SIR,—In the early part of the year, I submitted to the Technical Press a mode of putting into effect a proposal to sell gas on a heat-unit basis; and I made a suggestion for incorporating with the usual sliding-scale an additional scale based on coal prices.

Further consideration of this has led me to the conclusion that the suggestion is an impracticable one; and I should be obliged if you would allow me the opportunity of withdrawing it.

CHARLES CARPENTER.

South Metropolitan Gas Company,
709, Old Kent Road, S.E., Dec. 23, 1919.

A Coal Clause and the Gas Sliding Scale.

SIR,—Your remarks on the proposal to vary the standard price of gas according to the cost of coal at works have greatly interested me, and I am glad to see you are in agreement with us as to the impolicy of the proposal in cases like that of the South Suburban Company. We regard it as wholly opposed to the principle of the sliding-scale. But unless I am much mistaken, it has now been completely upset by the recent announcement of a 10s. drop in the price of coal. At all events, this should have opened the eyes of every one to the impossibility of accepting the cost of coal—whether at works or f.o.b.—as a sole governing factor. What, for example, would have been the position of the gas industry had such a proposal already become law? It is surely apparent that a distinctly broader view must now be taken, if the necessity for periodical revision of what are likely to be the standard prices of the immediate future is admitted; and we, at any rate, have endeavoured to give expression to this in the terms of our Bill.

CHAS. HUNT.

Beckenham, Dec. 27, 1919.

Crude Ammoniacal Liquor for Agriculture.

SIR,—The publication in your issue of the 23rd inst. of an article on stimulating agriculture and gardening by means of crude ammoniacal liquor is opportune and suggestive from many points of view, calling to mind spasmodic efforts made in different parts of the country long, long ago.

As gas-works increased in number and usefulness, small undertakings experienced difficulty in disposing of liquid products. Prosecution for pollution became acute, and magisterial decisions being generally adverse to the defendants, efforts were made in the direction of land fertilization by liquor and road making and mending by gas tar. At that time both kinds of residuals could be had for the asking. But our insular prejudice against innovationists was much in evidence; and the charm for the most part prevailed not. Fortunate were those whose works were in proximity to disused coal mines, which often became the recipients of waste material nowadays about equal in value to the coal won from the pit now obsolete.

I, Sir, am persuaded that if the veterans of the industry could be induced to narrate their experiences in this connection, it would make excellent, and in some cases romantic, history. Still, some able men did use crude ammoniacal liquor in cultivation, and over sixty years ago a quondam gas manager of a small works at Melbourne, Derbyshire, astonished the locality by his success in gardening, using crude ammoniacal liquor as a fertilizing agent. His success with vegetables was at that time phenomenal—especially with cabbages, celery, carrots, and root crops generally—so much so that his garden was raided at night by rival competitors to secure exhibits at local flower-shows. One delinquent was cleverly detected by the judges cutting open some prize carrots, thereby disclosing fine copper wire which had been inserted by the grower during the growth of the vegetables. The prize was then awarded to the *bonâ fide* producer. Perhaps our friends at Melbourne and elsewhere would place on record the results of using the crude liquor in promoting vegetable productivity!

The writer can remember some more or less successful experiments half-a-century since on farm land. Grass land is a case where a winter dressing is attended with good results. A water-cart with distributing apparatus is an easy and convenient method of application. If too strong (a mistake often made), it bleaches the grass by destroying chlorophyl—the ordinary green colouring matter of leaves of plants, as also moss and other useless growths, thus promoting more healthy herbage. It also deals death to nocturnal insect marauders, and discourages the growth of parasites. Bleaching caused alarm in some cases, and further treatment was abandoned; but it was noticed that the crop next year was vastly superior, and a foot taller than on land left untreated with the liquor.

The information from Copenhagen—especially the dates for successful application—is valuable to florists and others, and should be widely disseminated among all cultivators of the soil, and those who take an interest in agricultural pursuits, tending to improvement and increased production per square yard cultivated. I am persuaded that potato disease can be eradicated by crude ammoniacal liquor, thus abolishing the disinfecting process by spraying the haulm. *Experientia docet.* Who will undertake the task and earn the praise and thanks of a grateful community? It is said that he who makes too blades of grass grow where only one grew before is a benefactor to his country!

CHARLEYMANGE.

London, E., Dec. 27, 1919.

Fire at the Sedgley Gas-Works.—A fire, which might have been attended with serious consequences, broke out at the Sedgley Gas-Works, Lower Gornal, on Wednesday morning last. The Dudley fire brigade were summoned to the outbreak, and found the store-room well alight. The stores were all destroyed; but the brigade prevented the fire from spreading to tanks containing tar and ammonia, upon which the store-room is built. The damage is estimated at £250.

REGISTER OF PATENTS.

Pipe-Joints.—No. 122,636.

LOCK-JOINT PIPE COMPANY, MITCHELL, J. C., HIRSH, A. M., and BARTRAM, G. C., of East Orange, New Jersey, U.S.A.

No. 1185; Jan. 16, 1919. Convention date, Jan. 7, 1918.

In laying pipes which require to have water-tight joints, the patentees claim to have devised a joint which "meets fully all practical requirements." It has been proposed, they say, to form spigot-and-socket joints for metal piping in which the plain spigot end is adapted to force a resilient gasket into a circumferential groove or depression formed in the interior of the socket when the spigot is inserted in it to form the joint. Moreover, it has also been proposed to make packing-rings of lead tubing containing a core of material, such as asbestos, hemp, or the like.

According to the present invention, a ring or gasket of this character is placed inside the bell-end of one of the pipe sections in an annular recess in it provided for the purpose, terminating in a circumferential abutment, at the junction of which, with the recess, a circumferential groove is formed in the wall of the recess. The tapered front portion of the spigot end of the other pipe section is then inserted into the bell-end of the bell-pipe section—entering the annular gasket contained in it, and the two pipe sections are then forced together, so as to compress and flatten the gasket radially, pressing it tightly against the cylindrical wall of the recess and also against the abutment, and at the same time causing it (by the "flow" of the material of which the gasket is composed), under the pressure exerted, to enter and tightly fill the circumferential groove in the wall of the recess at the junction of the latter with the abutment—thus anchoring the gasket in place "beyond possibility of after-disturbance."

Prepayment Gas-Meters.—No. 134,322.

RAWLINGS, J. S., of Peckham, S.E.

No. 17,816; Oct. 31, 1918.

This invention has reference to prepayment gas-meters which are adjustable by means of a price-changing plate adjusted relatively to the quantity wheel; and the invention provides for a safety arrangement for the prevention of fraud and for a direct gear between the quantity wheel and the screw of the gas-controlling valve.

The construction comprises a circular box fixed on the front of the meter—that is, on the same side as the index—and containing at the back a toothed quantity wheel fixed on a short axle, the rear end of which projects beyond the back of the box and has fixed on it a worm-wheel in direct engagement with the screw of the gas controlling valve. Within the box is the coin-carrier mounted on a shaft coaxial with the quantity wheel. Normally, there is no connection between the coin-carrier and the quantity wheel; so that the former can be turned without affecting the quantity wheel.

The front of the box is closed by a graduated price-changing plate the position of which in a rotary direction is shifted so as to limit the extent of movement of the coin-carrier relatively to the quantity wheel as may be necessary in accordance with the price of gas. A coin slot is provided in the price-changing plate opposite the coin-pocket of the carrier.

The locking of the coin-carrier to the quantity wheel is effected by the inserted coin, which presses a spring catch on the carrier into engagement with the quantity wheel. The recoil of the spring effects disengagement when the coin is ejected (preferably by the same spring) on arriving opposite the place of discharge.

A cover for the coin-slot is provided which prevents the coin-carrier from being turned, after a coin has been inserted, until the coin-slot is covered. This consists of a plate mounted on the front of the coin-carrier, and caused to slide thereon by a finger (mounted on the shaft) which enters a slot in the plate.

Utilizing Residues from Bituminous Shales, Cannel Coals, &c.—No. 133,452.

BROXBURN OIL COMPANY, Ltd., of Glasgow, and FINDLATER, R. H., of Broxburn, N.B.

No. 16,542; Oct. 11, 1918.

The residue from bituminous shales and the like, as produced in various forms of retorts, has hitherto been regarded (the patentees mention) as of no value, and has been deposited in the neighbourhood of mineral oil works or the like in large heaps.

Generally, the present method of distilling bituminous shales consists in retorting them under conditions of temperature, rate of movement, and steam supply, which leave in the residue varying percentages of fixed carbon, after driving off the volatile matters. For the purpose of this invention, the process of retorting shales may be modified in such a way as to leave in the residue any desired percentage of fixed carbon. The object of the invention, therefore, is to provide means by which the fixed carbon and other valuable materials in the residue may be profitably utilized by subjecting them to various chemical treatments, the result of which is to produce (in the first place and essentially) carbon in very porous form, suitable as a decolorizer, and, for other purposes, aluminium hydrate, hydrates of iron, silicate of soda, and sulphate of lime.

In carrying out the process, the residue from the retort is conveyed to a grinding mill of such construction that the material is reduced to powder, the particles of which are not larger than will pass through a screen of 100 meshes per linear inch. From the mill, the ground material is delivered, preferably by a bucket elevator, into a cast or wrought iron hopper, above an acid resisting closed digester provided with stirring gear, or means of agitating with air and open steam, also with a vent to convey the disengaged gas to the atmosphere or else-

where, and with a swivel-jointed pipe, or with cocks on the outside, at different levels, for running off the liquor.

A certain quantity of water is first placed in the digester, and the ground material added through a valve and acid-resisting pipe leading from the hopper under the surface of the water. The water and ground material are now agitated together until no further solution takes place—the mixture then being settled, and the settled liquor run off for recovery of any alkali or alkaline earths it may contain. Into the digester is now introduced a certain quantity of dilute sulphuric acid, of 100° Twaddel strength, raised to boiling point by the steam provided; the mixture of acid and ground material (water washed) being agitated till no further solution takes place. The mixture is now diluted with water and allowed to settle—the clear liquor being run into an acid resisting tank or cistern. Clean water may now be run on to the exhausted ground material and agitation repeated, the mixture settled, and the washings run to the cistern. Finally, the exhausted ground material, mixed with water, may be pumped into thorough extraction filter presses, or other type of filter, and washed *in situ* with fresh water till all soluble matter has been extracted and passed to the cistern.

The clear liquor is allowed to cool, and any sulphate of lime deposited from the solution may be recovered by pumping the mixture of clear liquor and sulphate of lime through filter presses, or other form of filter. The clear liquor is led from the filter by acid resisting pipes to saturators; the sulphate of lime being conveyed to a drier of some known type.

Controlling or Operating Means for Bunsen Burners. No. 134,718.

HUTTON, J., of Dublin.

No. 3182; Feb. 10, 1919.

This invention has for its object to provide means whereby the supply of gas to the burner is automatically reduced when not being used. This is effected by interposing between the gas supply pipe and the bunsen burner a tap or valve adapted to be operated against the action of a spring fixed (or rotatably secured) to an extension of the gas tap or valve; the other end of the spring being adapted to press against a stop—such as the extension of the gas supply pipe. The gas-tap is provided with the usual stop; and the arrangement of control or operating means is such that the gas may be turned on by handle to its full degree against the action of the spring and stop, and when the lever is released the action of the spring and stop automatically reduces the supply of gas to the flame by causing the tap to rotate to a predetermined degree against the tap stop so as to bye-pass enough gas through the main orifice in the gas-tap plug into the burner to keep it alight; and when it is desired to keep the flame on full, the spring is rotated to an inoperative position so as to permit of the tap being turned on full.

Regulating Temperature in Water-Heaters. No. 134,622.

STOTT, V. H., and SCHOFIELD, L., of Oldham.

No. 18,264; Nov. 7, 1918.

This invention relates to water-heaters of the class where the heating medium is controlled by the vapour of expansion acting upon a float which, in turn, operates the controlling valve. The float is in a separate chamber, partially submerged (or in some other way fixed) so that its water is kept separate and distinct and prevented from mixing with the water to be heated for use. Thus the heat transmission from one body of water to the other is only by means of, or through, the metallic bottom or wall of the chamber.

Quenching Coke.—No. 134,867.

WELLINGTON, S. N., of Victoria Street, S.W.

No. 13,452; Aug. 19, 1918.

This invention is designed for application to high-temperature coke-ovens. It has, among its objects, to utilize the heat of the incandescent coke, on its discharge from the oven, to reduce the production of waste coke or breeze, and generally to provide an apparatus simple in construction, into which the incandescent coke may be directly and quickly discharged without being broken, and in which it may be quenched, and from which it may be conveniently discharged into wagons, barges, or the like.

There is a jacketed receptacle of a length slightly more than that of the charge of coke from the oven, and of a corresponding width, having its respective ends capable of being closed by sliding doors. Along the bottom is an endless conveyor or chain grate, the movement of which may be so effected that the rate of movement corresponds to the rate of discharge of the coke from the oven by the ram, and so that the charge may be loaded into the receptacle substantially intact, and without considerable breakage or exposure, and as readily discharged after being quenched and cooled.

The receptacle is of rectangular transverse section, whereby a water chamber or jacket is formed of inverted U shape, extending from the top to the respective sides. A series of spray pipes are provided in the upper part of, and within, the receptacle, into which water passes for spraying, from pipes whose opposite open ends extend downwards into the lower parts of the U-shaped chamber or jacket. Thus, on the charging of the receptacle with incandescent coke, the water in the surrounding jacket is heated and steam is generated, so that, on a determined pressure being attained, the heated water under pressure is discharged through the spray pipes, and quenches the coke.

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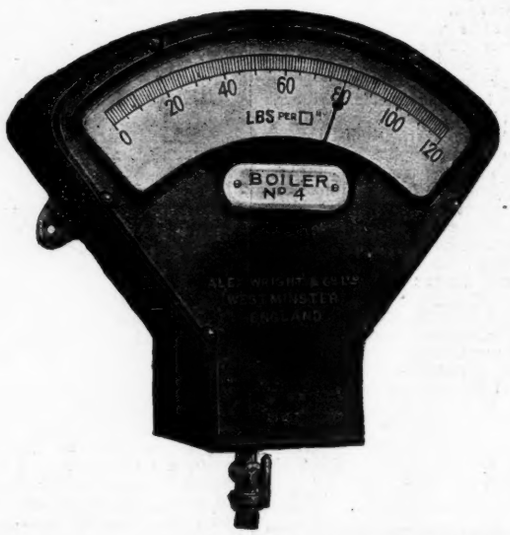

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Incandescent Gas-Mantles.—No. 134,875.

WILSON, J., of Birmingham.

No. 16,465; Oct. 10, 1918.

According to this invention, a flexible gas-mantle is made of a flat piece of impregnated fabric, so folded or bent as to form a bottom opening for the insertion of an upright bunsen burner, and supported over and around the vertical flame so as to enclose it at the top and on all sides except one. The same mantle can be used with an inverted bunsen burner furnished with laterally projecting hooks on to which the mantle can be hitched.

Gas-Fired Boilers.—No. 134,938.

KIRKE, P. ST. G., of Parliament Mansions, Westminster.

No. 18,718; Nov. 14, 1918.

The patentee claims to have found that it is possible to burn completely within a boiler-tube, by means of substantially the theoretical proportion of air, a gas supplied at a rate compatible with efficiency "if due attention be paid to the dimensions of the tube." For example, he burns completely with nearly the theoretical amount of air a rich gas like town gas in a small tube surrounded by hot water, with or without primary air, provided that the tube is very long in comparison with its diameter. Say the suction is ¾ in. water pressure, combustion is not complete when the air is substantially the theoretical proportion in a tube having a length of 30 diameters; but it is complete in a tube of the same bore having a length of 60 diameters. If, however, the suction be considerably increased, even a length of 60 diameters is not sufficient to ensure complete combustion.

The main feature of his invention consists in constructing a gas-fired boiler of the fire-tube type with tubes sufficiently long in comparison with their diameter to ensure complete combustion within them of the gaseous fuel used at the desired pressure—the proportion of air for combustion being substantially that theoretically necessary. This means that, for a given length of boiler, the diameter of the tubes is much reduced compared with known constructions, so that a larger heating surface can be obtained for a given diameter of shell—thus reducing the cost of the boiler.

He has further found that, when gas is burnt in a tube by induced draught, the tube must be of great length if the products of combustion are to be reduced to the low temperature necessary for efficiency. For instance, with a suction of 5 in. water pressure, he finds that a tube of 1 in. diameter must be 190 in. long if the temperature of the products of combustion is to be reduced below 320° C. above the temperature of the steam in the boiler. For full efficiency, therefore, either the tubes must be of very small diameter or the boiler must be unduly long.

Another feature of the invention (to overcome this difficulty) consists in providing, as an addition to the tubes of sufficient length to ensure complete combustion with substantially the theoretical proportion of air, tubes in a separate drum, or return tubes in the same drum, for extracting the sensible heat from the products of combustion leaving the first tubes.

The cross sectional area of the combustion tubes has to be selected with reference to the rapidity of the combustion; since when this exceeds a certain limit, the boiler becomes too noisy. This necessity does not obtain in the case of the tubes for the products of combustion, which, on the other hand, should be of comparatively small cross sectional area, so as to secure the maximum heating surface. For example, it is advantageous to have two or more return tubes for each combustion tube of correspondingly smaller cross sectional area than the combustion tube.

When a superheater is used, the temperature of the products of complete combustion with substantially the theoretical amount of air may be so high as to burn the superheater. In this case, the length of the combustion tubes relatively to their cross sectional area should be such as to ensure a temperature of the products that issue from them suitable for heating the superheater, which is preferably placed in a chamber controlled by a damper, so that the proportion of the products of combustion flowing over the superheater before passing through the tubes that extract sensible heat may be varied.

The invention is primarily applicable to gas-fired boilers in which the tubes are supplied each by its own burner, and particularly in combination with the arrangements described in patent No. 124,016.

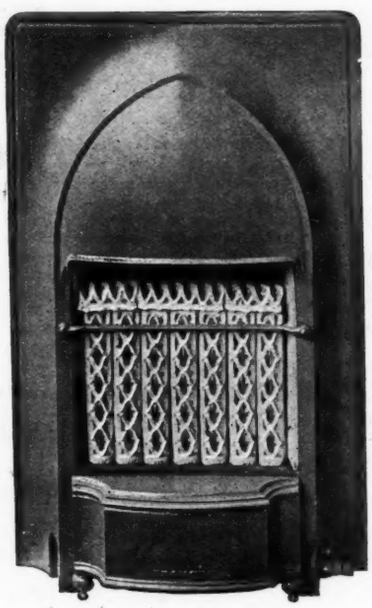
Treatment of Gases containing Sulphur Dioxide.—No. 134,943.

ESPENHAHN, E. V., of Port Pirie, South Australia.

No. 18,772; Nov. 15, 1918. Convention date, Nov. 15, 1917.

This invention refers more especially to the treatment of flue gases from metallurgical operations containing small proportions of sulphur dioxide—such as from 1 to 2 p.ct.—which have hitherto not been amenable to treatment for the economical recovery or utilization of the sulphur dioxide. The object is to treat such gases so that the sulphur dioxide is economically recovered as free sulphur and sulphur dioxide in concentrated form. This sulphur may be burnt for the formation of sulphur dioxide, which, as well as the sulphur dioxide formed in the process, may be used for the manufacture of sulphuric acid or for other industrial purposes. Furthermore, another product of the process may be sodium thiosulphate in commercial form.

Bilston Gas Company.—The profit and loss account, after paying the usual interim dividends, shows a credit balance of £17,969. It is proposed to pay further dividends of 5s. 6d. per share on the "A" shares, less tax, and 4s. per share on the "B" shares, less tax, making 11s. and 8s. per share respectively for the year, and leaving a balance of £16,080.



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MISCELLANEOUS NEWS.

AN INSPECTION OF THE GREENOCK GAS-WORKS.

Members of the Association of Engineers and Shipbuilders last Saturday week paid a visit to the Inchgreen Gas-Works of the Greenock Corporation, where they were received by Mr. George Keillor (the Engineer and Manager) and Bailie John Paterson (the Convener of the Gas Committee). In the course of the inspection, Mr. Keillor personally explained modern methods of gas production, and gave practical demonstration of the working of different parts of the plant. Subsequently tea was served, and Mr. Keillor and Bailie Paterson were heartily thanked for the instruction and enjoyment which the visit had afforded.

In connection with the inspection, a pamphlet descriptive of the works, and containing an account of the history of gas supply in Greenock, had been prepared. The make of gas in 1828 and 1829 was 3,200,000 c.ft.; whereas for the last financial year the quantity produced was 543,506,000 c.ft. The figure of make per ton of coal carbonized has gone up from 10,232 c.ft. in 1914-15 to 14,280 c.ft. in 1918-19. The works at Inchgreen (which are on a site of approximately 8¾ acres) were originally designed for the manufacture of two million c.ft. of gas per day; but by adopting modern methods, and re-arranging existing buildings and railway sidings, the site has been made capable of being utilized for the production of fully double this quantity. There are still in the old retort-house horizontal retorts of a capacity of 700,000 c.ft. per day; but a Woodall-Duckham vertical retort installation was brought into use at the end of 1914. There are 32 vertical retorts, each capable of carbonizing 5½ tons of coal per 24 hours, giving a total throughput of 180 tons of coal, and yielding (when first-class coal is used) a total of 2,000,000 c.ft. of gas per 24 hours. With average quality Scotch coal, the pre-war producing capacity of the installation was only 1,850,000 c.ft. per day; but at present, with a throughput of 3¾ tons per retort per day, and the steaming of the charges, 2,100,000 c.ft. of gas per 24 hours is obtainable.

The mono-rail electric telpher machine is of Messrs. Strachan & Henshaw's free swivelling double bogie type, complete with hoisting and travelling motors, controller, &c. The mono-rail telpher track is about 605 ft. long.

All the electrical energy required on the works is supplied by three Westinghouse direct-coupled shunt-wound protected type D.C. generators. The gas-engines driving the generators are of 42 maximum B.H.P., running at 240 R.P.M. of the British-Westinghouse horizontal single-action type.

The water-gas plant is capable of producing 750,000 c.ft. of blue water gas per 24 hours. Starting from cold, gas can be produced in from six to eight hours. The plant was erected by Messrs. Perry & Co., of London. It consists of two generators, of special internal design, complete with fool-proof air-blast, gas, and steam valves, a scrubber, and a steam turbine blower. The machinery-house is equipped with air, steam, and gas meters, CO_2 and cycle recorders, water and oil circulating pumps, and a steam turbine blower. The gas produced averages 310 B.Th.U. per c ft., is of high flame temperature, and contains 92 p.ct. of combustibles.

Owing to the ever-increasing demand for gas, and the inadequacy of the low-pressure trunk mains for distribution purposes, two gas-compressors were erected during 1913, each capable of delivering 20,000 c.ft. of gas per hour against a pressure of 25 lbs. per sq. in. The gas in the high-pressure main is passed into the low-pressure mains at various points through Reynolds' governors and district controllers.

GAS STOKERS' STRIKE AT EXETER.

Stokers at the Exeter Gas-Works, to the number of about 50, struck work suddenly last Tuesday afternoon as a protest against one of their number—a man named Fisher—being given the position of engine exhaustman. They refused to work under Fisher, and also objected to the manner in which the post was given him.

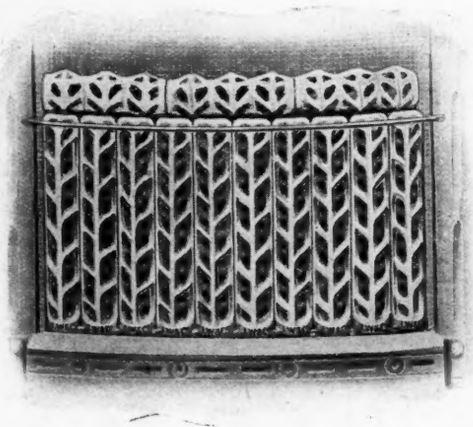
The following letter from Mr. W. N. Westlake, the Secretary of the Gas Company, explained the position: "One of the employees of the Company having just left to take up a better appointment in the North of England, arrangements were made on Tuesday for another man to carry on his duties. Some of the stokers objected to the man selected, and on Tuesday afternoon sent in a peremptory message to the effect that they would 'down tools' if either of the two supernumerary men was selected. No interview preceded this message, nor were any steps taken to explain the reason for their action. The organizer of the men's Union was immediately communicated with; and he promised to get in touch with the men. As far as I am aware, the Union has not authorized the action. Notwithstanding that the seriousness of the threatened action was pointed out to them on Tuesday, the men persisted in their attitude."

The strikers held that vacancies should be posted and regularized, so that one man should not get an advantage over the other.

Some of the night-shift men resumed work at their appointed time; but others held out. In the emergency, the Company took prompt measures to secure that the public had sufficient gas to cook their Christmas dinners and illuminate their houses. The Directors appealed for the co-operation and forbearance of the public, and asked for volunteers to help to keep the gas supply going, particularly over the Christmas holidays; and several citizens came forward. Their assistance, however, was not required.

At mid-day on Wednesday, the strikers returned to their work unconditionally; the strike having lasted twenty-four hours.

The following are the terms of settlement: All stokers who stopped



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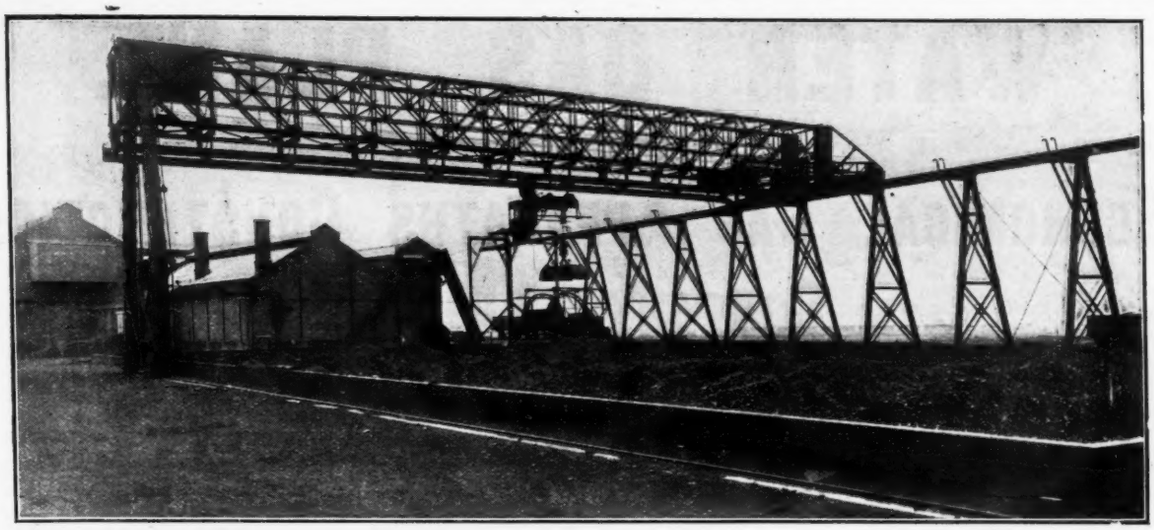

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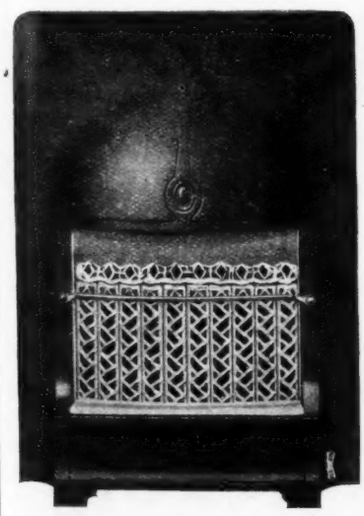

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"Steamless" Radiators

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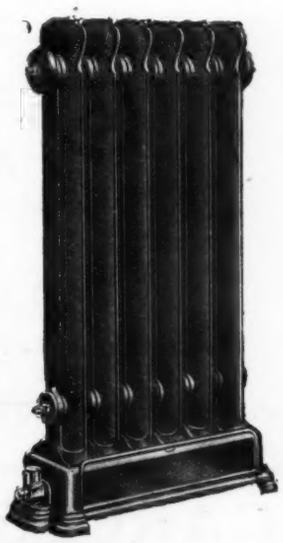

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Specially distil Carburine Spirit, Specific gravity ·680, or of any other grade suitable for Enriching Gas, also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.

Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthalene, &c.

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work to return to their duties unconditionally. It is to be understood that the men employed by the Company have no right to question the appointment of any man to a particular job. The men to have the right to put forward other grievances for consideration through the usual channels, as they have always been able to do in the past.

THE GATTIE GOODS-HANDLING SCHEME.

Adverse Report by the Committee.

The report was issued just before Christmas of the Departmental Committee appointed to investigate the proposals of Mr. A. W. Gattie [an outline of which was given on p. 226 of the "JOURNAL" for Feb. 4 of this year] for improving the method of handling goods and traffic, and to consider the practicability of introducing any of the suggested improvements into the existing transport system.

The Committee's objections to a central clearing-house for London on the lines suggested are:

(*a*) The huge capital expenditure required.
(*b*) The displacement of a large population.
(*c*) The impracticability of the large volume of traffic involved being conveyed over the railway lines connecting the trunk systems and the clearing-house.
(*d*) The concentration of the whole of the goods traffic at one spot, which would mean that all street traffic from whatever quarter would converge on that particular area, thus creating a central congestion area.
(*e*) The necessity of maintaining most of the existing depôts, as coal and mineral traffic could not pass to the clearing-house.
(*f*) The complete upheaval of all the practices and customs of the carrying-on of public trade which would result from the establishment of the proposed clearing-house, worked as the New Transport Company desire, quite apart from its effects on railway working throughout the country.
(*g*) The fact that this proposed method of dealing with goods for sorting would increase the amount of handling; for, on the arrival of a train, the container would be hoisted to a sorting floor, where the goods would be removed by hand, and placed on trays and then dispatched to a specific berth, where they would again be removed by hand, placed in a further container by hand, and returned by crane to street or train vehicle, as required; whereas now, when the train arrives, goods are sorted as they leave the wagon, are then hand-trucked to specific berths and loaded on vans or on wagons, and are then ready for dispatch.

Mr. Gattie did not wish the Committee to recommend the use of one portion of the system to the exclusion of another. The Committee consider this opinion to be founded on a correct appreciation of the necessity for co-ordination of all the traffic, if the clearing-house system in large centres should be found suitable for adoption. If the Gattie scheme were adopted, it must be applied to every town in the country; and machinery for handling the containers would have to be provided at every goods station remaining in operation. No detailed estimate has been made of the cost of this; but Mr. Gattie suggested that at pre-war figures it might cost £300,000,000. At present-day costs, the outlay would be very much greater, and the Committee feel that they cannot recommend such an expenditure of public money.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 29.

Business during the past week has been quiet on account of the holidays; but, nevertheless, prices maintain their firm tone. Pitch continues to advance in value. It is reported that over 90s. per ton net in bulk at makers' works has been paid; while makers' ideas are higher to-day. Creosote continues in demand; the price being firm at about 7½d. per gallon net in bulk. Tar spirits and other products are unchanged.

There is nothing new to report in sulphate of ammonia.

Tar Products in the Provinces.

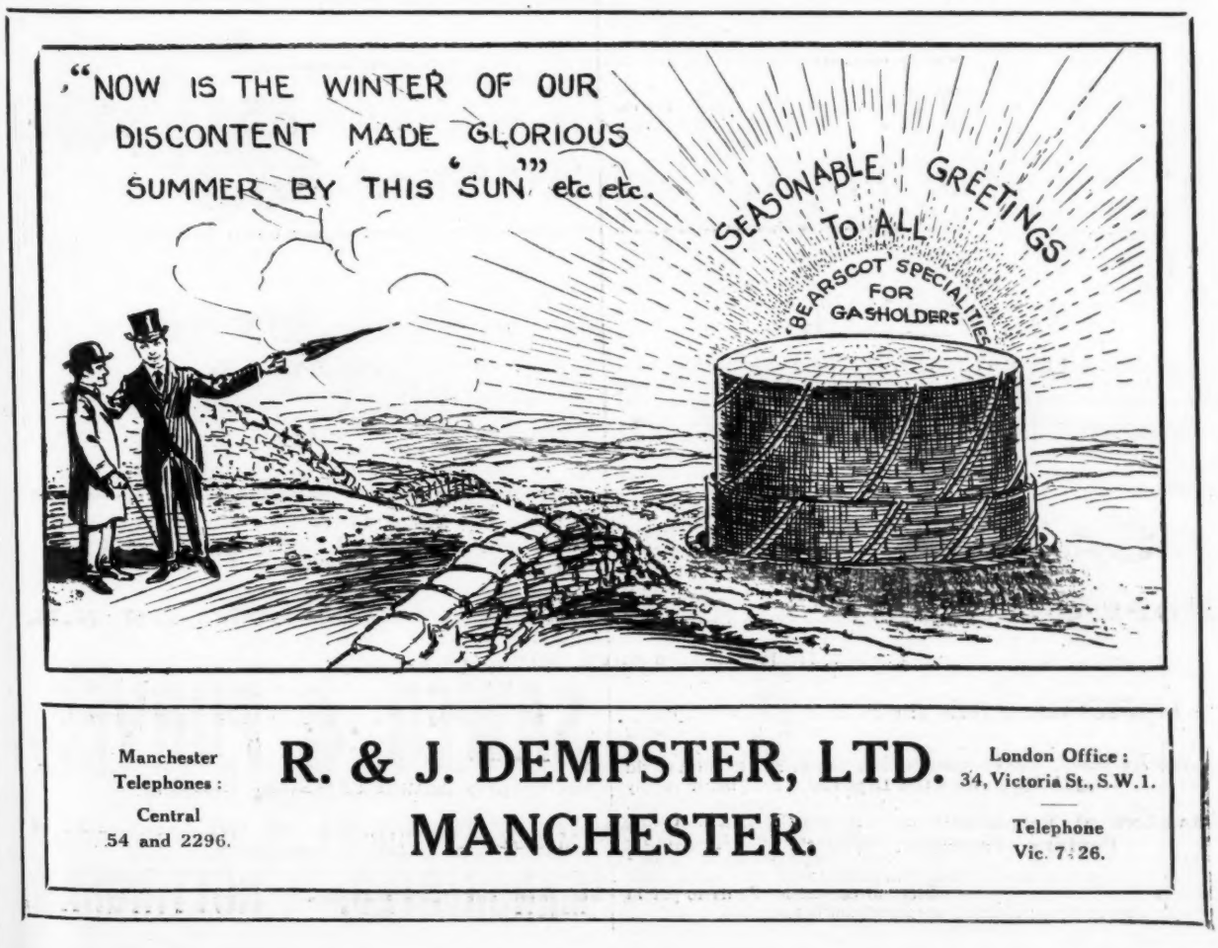
Dec. 29.

The average values for gas-works products during the week were Gas-works coal tar, 45s. 9d. to 50s. 9d. Pitch, East Coast, 87s. 6d. to 95s. per ton f.a.s.; West Coast—Manchester, 70s. to 75s.; Liverpool, 70s. to 75s.; Clyde, 80s. to 82s. 6d. nominal. Benzol 90 p.ct., North, 1s. 11d. to 2s.; crude 65 p.ct. at 120° C., 1s. 1½d. to 1s. 2½d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 10d. to 2s. Toluol, naked, North, 2s. 1d. to 2s. 2d. nominal. Coal tar crude naphtha in bulk, North, 9d. to 9½d. Solvent naphtha, naked North, 2s. 10d. to 3s. Heavy naphtha, North, 2s. 4d. to 2s. 6d. Creosote, in bulk, North, liquid, 6½d. to 6⅝d.; salty, 5⅜d. to 6¼d. Heavy oils, in bulk, North, 6⅞d. to 7d. Carbolic acid, 60 p.ct., 2s. 6d. to 2s. 7d. Naphthalene, £18 to £22; salts, £6 10s. to £7 10s., bags included. Anthracene, "A" quality, 7½d. to 8d. per minimum 40 p.ct.; "B" quality, nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

Very little has happened since my last report; but conditions continue very firm, and there appears to be no sign of any slackening in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interest. Makers seem to be well sold forward. Pitch maintains exceptional strength, and finishes the year at considerable appreciation. The advance that has taken place, however, cannot be regarded as excessive or unjustified, having regard to the increased costs of production and the higher range of quotations for other products compared with a year ago. Stocks have rapidly diminished, and now hardly exist, with the result that even higher quotations are being looked for early in the New Year by well-informed authorities. Crude tar is without alteration. There is no change to report in benzols; and 90 p.ct. is nominally worth 2s. 2d. per gallon. Naphthalenes are rather in request; but there is very little on offer. Naphthas are firm—solvent being somewhat scarce, even at late rates, in Provincial centres, while rather higher prices are being paid for heavy sorts. Carbolic acid maintains its strength, and should prove a very profitable venture for those makers who took over the Government stocks a few weeks ago—particularly if the Japanese buying continues. Crystals are still difficult to obtain, and prices are unreliable. Creosote is firm, and tends to a higher range of value. The export demand is in excess of the supply; and there is very little available for prompt delivery. Users of fuel evidently conclude that, no matter the price of liquid fuel, it is possible to save enough out of labour to pay for it. Prices continue to advance gradually. Cresylic acid is strong; and up to 3s. 6d. per gallon, in casks, has been reported. Quotations of leading intermediates are difficult to fix. Makers are heavily committed; while production in some directions is retarded for some reason or another. There is no change in the price of aniline oil, which remains scarce, with makers much behind in deliveries. Salicylic acid is very active, and good business has been transacted at 3s. 3d. to 3s. 9d. per lb.

The range of quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 10½d. North; crude, 60-65% 1s. 5d. to 1s. 7d.; pure, 3s. per gallon naked.

Carbolic Acid: Crude 60's 2s. 10d. per gallon nominal; crystals, 40%, 10d. per lb.

Crude Tar: London, 50s. to 55s.; Midlands, 50s.; North, 50s. per ton *ex* works. Refined tar, 32s. 6d. per barrel (free) on rail.

Pitch: London, 90s. to 95s. per ton; East Coast, 77s. 6d. to 85s. per ton; West Coast, 75s. to 80s., with Manchester 76s. per ton and Glasgow 80s. per ton; South Wales, 80s. to 85s. per ton.

Solvent Naphtha: London, 3s. 3d. Provinces average 3s. 4d. per gallon.

Crude Naphtha: Naked, 9d.; North, 8½d. per gallon.

Heavy Naphtha: 2s. 6d. per gallon.

Naphthalene: Refined, £18 to £20 per ton nominal; crude, £6 10s. to £11, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d. Pure, 3s.

Creosote: London, 7½d.; North, 6½d. to 7d.; heavy oil, 6d. per gallon in bulk.

Anthracene: 40-45%, 9d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 5d. to 1s. 6d. per lb., drums free.

Cresylic Acid: 95%, 2s. 9d. to 3s.; 97-99%, 3s. to 3s. 3d. per gallon *ex* works London, f.o.b. other ports.

Sulphate of Ammonia.

There is not much fresh to report in sulphate of ammonia. All the output goes away at once; and there is very little left over for the export trade. Distribution will continue under the control of the Association until the end of May next, after which it is probable that all forms of restriction will be removed, and manufacturers be free to make sales where they will. But much, of course, depends upon the Government's new agricultural policy. It would seem, however, that the authorities will shortly be more willing to favourably consider export propositions—if we may read anything into the request that early intimation of spring requirements should be notified to the Association, "in order that a sufficient quantity may be provided to satisfy home demands, and that the distribution between home buyers and exporting firms may be properly regulated."

A Lightning Strike at Burnley.—Following a lightning strike at the Burnley Gas-Works on the evening of Dec. 19, the Committee met to consider the cause of the trouble. The coke-wheelers had been asking for extra manual assistance. The Gas Engineer (Mr. J. P. Leather) has been in negotiation for the supply of large barrows, which would collect the coke as it fell from the retorts, so as to save the men the labour of having to shovel it from the ground into the existing smaller barrows.

Cause of Complaints at Dundee.—In a report which he has submitted to the Gas Committee, Mr. Alexander Yuill (the Gas Engineer) says experience at Dundee shows that defective fittings are the chief cause of complaint. Consumers as a rule are unable to determine the true cause, and, if they do not obtain a sufficient supply of gas, invariably throw the blame on the quality. In one tenement sixteen jets, six rings, two cookers, and two gas-fires were all supplied through a ⅜-in. inlet-pipe. Under these conditions, it was impossible for the tenants to obtain an adequate supply of gas. Mr. John Reid said ten years ago the same difficulty arose, and proprietors were circularized and asked to have their property fitted with more modern pipes. There was not much response then; there would be less under present conditions. It seemed to him that the only remedy they had was for the Committee to put the necessary pipes into the houses. The work would cost about £25,000. Spread over a number of years, this would not be a serious burden on the Gas Department, as a better supply would be given, and the department would earn increased revenue. Several members held that the quality of the gas was at fault. Owing to the fact that the Council had no power to make the proprietors refund the money spent on pipes, Mr. Reid's suggestion found no support. As an alternative, he moved that in their next Provisional Order the Council should apply for powers to compel landlords to put in proper sizes of pipes; and this was unanimously agreed to.

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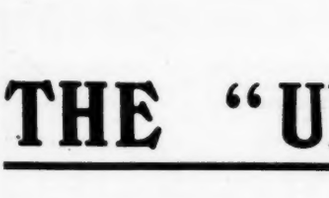
THE "UNEEK"

Two-way Tap.



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Simply alter Position of Screwed Plug.

USED AS ELBOW TAP.

Elbow Stove Tap No. 154.

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MILES PLATTING, MANCHESTER.

RADFORD ROAD, NOTTINGHAM.

LOCATING GAS-MAINS BY WIRELESS.

It is stated by the "Sydney Sunday News" that hidden gas-mains are now being located by the Australian Gas Light Company by means of a wireless pipe-locater, the application of which is as simple as it is effective. With it, the Company recently located in ten minutes a lost main, which had been unsuccessfully searched for, at varying periods, for fifteen years; and the cost of manual labour during this time more than doubled the cost of the instrument. The locater consists of a specially-designed battery, and what is technically termed a "detector coil." This looks like the frame of a school slate. Through it runs a coil of wire capable of picking up wireless waves. Connected to it is a receiver, in every respect identical to that of a telephone. Assume that the operator wanted to give the exact location of a main which he knew existed a few feet from his doorway. He finds where the piping enters his home from the main, attaches a piece of wire to it, and connects it with the battery, which he places in the most convenient position. He then finds where the service enters the house adjoining, and twists a second piece of wire round the pipe, and runs this to the battery. He now has a complete circuit from the main, along the connecting-pipe to his neighbour's house, along the wire to the battery in his own house, along the second piece of wire to his own piping, and along his own piping back to the street-main. The area thus described is known as a field. Taking the detector coil (which is altogether independent of the battery or connecting wires), he holds it close to the ground, and through the receiver, which is strapped to his head, he hears the buzzing sound set up by the coil receiving the wireless waves from the circuit of wires and pipes. He moves quickly over the ground, and, when he approaches the main, the buzzing sound grows. When within an inch or two, it is very loud; but when he is immediately over the pipe line, it ceases. When this happens he knows the main is directly below. If he goes beyond the pipe line—that is out of the "field" he has set up—the buzzing is so faint as to be hardly audible. If, however, having once discovered the pipe line, he walks along, moving the detector from right to left as he goes, it sets up a sound which, once heard, he will always remember. A distinct break occurs in the buzz (or hum of wireless waves) as it passes directly over the main; and as long as this break occurs he knows that he is passing the detector backwards and forwards over the main, and may follow it for any distance within the circuit.

Increase in Price of Gas Oil.—The price of gas oil has been increased 3d. per gallon, making the current price 11¼d. per gallon, in bulk, *ex*-wharf.

Short Coal Deliveries at Padiham.—The Gas Manager (Mr. A. F. Ames) reported to the Padiham Council last week that deliveries of coal had been very bad; the total quantity received being only 409 tons. Within a month the stock had decreased by 374 tons, to 580 tons. Owing to the increase in the demand for gas, it will be necessary to make provision to adequately meet it next winter, by having two beds of inclined retorts reset.

Breakdown at Bingley.—The Chairman of the Gas Committee (Mr. T. Turner), at the Bingley District Council meeting last week, explained that the failure of light (already reported in the "JOURNAL"), after a temporary breakdown, was due to absolute exhaustion of store owing to short coal supplies. He added that the storage was only equal to about two-thirds of a full day's consumption at this period of the year. The position had arisen because they had tried to supply Cullingworth in consequence of the works there being out of action for want of parts of plant ordered last July and only just received.

Scunthorpe New Gas-Works Scheme.—After considering plans and estimates submitted by the Gas-Works Manager (Mr. S. Moore), the Scunthorpe and Frodingham Urban District Council have decided to proceed with the erection of new gas-works on the site in Dawes Lane. Mr. Moore's scheme was adopted subject to its final approval by an expert gas engineer; and the Chief Engineer of the Sheffield Gas Company (Mr. Horace Chamberlain) is to be asked to furnish an opinion regarding it. The Council also decided to apply to the Ministry of Health for powers to borrow a sum not exceeding £100,000 for the erection of new gas-works. The Chairman (Mr. A. Veitch) stated that the present gas-works were inadequate, and the plant in the wrong position. There had been no improvement since 1914, with the exception of the introduction of water-gas plant two years after the outbreak of war. The present works were for a maximum production of gas of 240,000 c.ft. per 24 hours; whereas the output had been 400,000 c.ft.—a serious overstrain upon the works. They could only carry out their obligations to the public by building new works; and these must be in operation before next winter.

Annual Dinner of the Sheffield Gas Company's Staff.—The annual and re-union dinner of the staff of the Sheffield Gas Company was held at Stephenson's Restaurant on the 17th inst., when a very enjoyable evening was spent; the dinner being followed by an excellent miscellaneous programme. The toast of "The King," by Mr. A. Revill Slater, was enthusiastically received; and Mr. J. R. Penrose proposed "The Sheffield Gas Company." Mr. Ralph Halkett (the General Manager), in reply, referred briefly to the past history and the promising future of the Company, and emphasized the need for united efforts on the part of all concerned. He also advocated more gatherings of a social nature, as tending to bring the officials and staff into closer touch with one another. During the evening, Mr. W. Whaley, on behalf of the ex-service officials, presented Mr. J. T. Meakin (the Chief Cashier) with a clock, suitably inscribed, as a token of gratitude and in recognition of his untiring efforts on their behalf, and his kindly interest in their welfare, while on active service. In acknowledging the gift, Mr. Meakin read out the names of fourteen members of the staff who had fallen in the war—the company standing in silence. The proceedings were presided over by Mr. John Emerson; and among those present were Mr. Horace Chamberlain (Engineer), Mr. Herbert Seagrave (Chief Accountant), and Mr. W. Hamby (Secretary).

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Retort-House Roof on Fire at Elland.—Fire broke out, on the morning of Christmas Day, in the roof of the retort-house at the Elland Gas-Works. The outbreak is believed to have been caused by a blockage in one of the pipes. The roof material caught fire; but the brigade were summoned, and were able to get the mastery before the flames became seriously dangerous. The whole affair lasted about an hour.

Unmetered Gas Supply in Sydney.—The difficulty of obtaining new meters has led to the adoption by the Australian Gas Light Company, of Sydney (with the consent of the Department of Labour and Industry) of a system by which the consumer contracts to pay in advance quarterly for an unmetered supply of gas to his house at certain schedule rates, based upon the rental value of the property, the number of persons in the household, and the cooking, lighting, and heating appliances connected. Obviously, says a local paper, the adoption of the flat-rate system effects considerable economies for the Gas Company (calculated at about 19s. per house per annum); but they are unable definitely to say whether any consideration has been given to the consumers on this account when compiling the schedule.

Gas-Workers' Wages Application.—A panel of the Industrial Court, consisting of Sir William Mackenzie, Mr. Bryce, and Mr. Cummings, heard an application last week by the unions included in the National Federation of General Workers, for an advance of 10s. per week for gas-workers aged eighteen and over, and 5s. for juniors, employed in gas undertakings throughout the country. The Court will later on announce its decision.

Price of Gas at Smethwick.—At the Smethwick Town Council last week, Alderman Pinkney (the Chairman of the Gas Committee) said that in consequence of the reduction in the price of coal most people in the town were looking for a very substantial reduction in the price of gas. The position, however, was a very difficult one; and he assured the Council that as soon as it was possible the Committee would reduce the price of gas to domestic consumers. They were threatened with an increase of freightage; and if this were only 2s. 6d. a ton, it would take away considerably from the amount they would like to reduce the gas by, while there was also the question of increased wages for employees at the gas-works, on which there were arbitration proceedings.

STOCK MARKET REPORT.

THE short half-week which ushered in Christmas Day exhibited some unusual characteristics. The week before, business had gradually melted away until by the close it had almost ceased to exist; and, if precedent were to rule, the prospect was that the three days intervening before the day would be a dead-calm. So far was this from being the actual case that an extraordinary outburst of activity supervened; and the general tone was very firm and cheerful.

In these agreeable conditions, the gilt-edged market had its full share. Home Government issues of all descriptions were in demand; and the final marks for the leading issues were: Consols 50⅞-51, War Loan 90⅞-91⅛, Funding 75⅝-76⅛, Victory 80¼-80¾.

Home Rails were quite in favour, actuated by a forecast of better times to come in 1920. Canadians were not strong. Argentines opened very well, but were thrown-back by reports of labour troubles.

The Foreign Market showed a variety of strong and weak points. One welcome feature was the recovery in French Loans, in view of a fairly substantial improvement in the exchange. Belgian and Chinese were firm; but Portuguese receded.

The Miscellaneous department also showed an assortment of varied fortunes. Rubber was in pretty good case, and closed strong; but oil was in a state of oscillation. Mines were in demand, and Textiles and Iron and Steel concerns were quite firm; but Shipping, Insurance, and Brewery were only moderate.

Business in the Gas Market was about as active as could reasonably be expected at this season; and, taking the entire run of transactions recorded, there was hardly any change in marked prices. There was, however, still a tendency towards easier figures in the London Companies; and South Metropolitan quotation was 1 lower. Gas Light ordinary did not vary; but there was no apparent tendency to recover yet. Imperial Continental was quite steady; but Continental Union and European were not in strong condition, and the quotation of the latter was ½ lower.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 56½, 57, 57½, Imperial Continental 135, 135¼, 135½, 136, 136⅛, 137, Monte Video 77½, Primitiva preference 65s., ditto debenture (1911) 50¼, South Metropolitan 57½. On Tuesday, Commercial 4 p.ct. 57½, ditto debenture 49½, Croydon "A" 136, ditto "B" 99, European 10½, Gas Light ordinary 56¾, 57, 57¼, 57½, ditto preference 64, Imperial Continental 136, 136¾, 137, 137⅛, ditto debenture 83, Primitiva 33s. 9d., ditto preference 62s. 6d., ditto debenture 71⅜, ditto debenture (1911) 50½, 50¾, South Metropolitan 57¼, 57⅜, Grays and Tilbury 82½. On Wednesday, Cape Town 6 15/16, Continental Union 30, Croydon "A" 136, 139¼, ditto "B" 99, 100, Gas Light ordinary 57⅛, ditto maximum 44, ditto preference 65½, ditto debenture 50¼, Imperial Continental 136¼, 137, Primitiva 33s. 9d., South Metropolitan 57½. The Exchange was closed for the rest of the week.

In the Money Market, there was a fair demand at the opening, but supplies became ample beyond all requirements; so that rates closed quite easy. The price of silver relaxed to 77⅛d. The Bank rate is 6 p.ct., as fixed on Nov. 6.

The acute coal shortage in France has resulted in the gas supply being cut off from some of the suburbs of Paris.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares	When ex-Dividend.	Ante-War Dividend & Bonus. p.c.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
189,049	Stk.	July 31	4	4%	Aldershot 4 p.c. Pref.	..	60—65	..
1,551,868	"	Sept. 26	2½	2½%	Alliance & Dublin Ord.	59—64	45—50	..
874,000	"	July 11	4	4%	Do. 4 p.c. Deb.	76—79	62—64	..
280,000	5	Oct. 30	7½	8%	Bombay, Ltd.	5⅞—6⅜	5—5½	..
50,000	10	Aug. 28	16	12%	Bournemouth Gas and Water { 10 p.c.	29—30	19—20	..
888,110	10	"	7	7%	B 7 p.c.	15—15½	10—11	..
115,000	10	"	6	6/-	Pref. 6 p.c.	13½—14	9½—9¾	..
159,740	—	June 27	—	4%	4 p.c. Deb.	..	65—67	..
992,045	Stk.	July 11	14	37/-	Brentford A Consolid.	361—366	66—61	..
794,930	"	"	11	31/8	Do. B New	304—309	52—57	..
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	76—78	..
321,400	"	Dec. 11	4	4%	Do. 4 p.c. Deb.	91—98	64—66*	..
214,775	"	Sept. 11	11	7½%	Brighton & Hove Orig.	208—218	123—128	..
244,200	"	"	8	6½%	Do. A Ord. Stk.	154—159	84—89	..
988,500	Stk.	—	5	5%	Bristol 5 p.c. max.	..	..	..
680,000	10	Sept. 26	12½	10%	British	44—45	25—27	..
120,000	Stk.	June 27	4	4%	Do. 4 p.c. Deb. Stk.	88—90	63—65	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	55—57	50—53	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	6½—7½	6½—7	6
180,000	10	Oct. 30	—	4½%	Do. 4½ p.c. Pref.	4—6	6½—7	..
100,000	Stk.	June 27	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	61—66	..
157,156	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	..
1,518,280	"	Aug. 14	5/9/4	33/4	Commercial 4 p.c. Stk.	106—108	56—61	57½
850,000	"	"	5¼	26/8	Do. 3½ p.c. do.	108—105	52—57	..
475,000	"	Dec. 11	8	8%	Do. 3 p.c. Deb. Stk.	69½—71½	49—51*	49½
600,000	"	"	4	—	Continental Union Ltd.	76—79	30—35	30
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	40—60	..
51,600	Stk.	Aug. 28	14½	12%	Croydon A 10 p.c.	..	135—145	135—139
878,400	—	"	11½	9%	Croydon B and C 7 p.c.	..	95—105	99—100
492,310	Stk.	—	8	6½%	Derby Con. Stk.	128—126	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	..	..
1,003,180	10	July 30	10	5/0	European, Ltd.	17½—18	10½—11½	10½
16,398,975	Stk.	"	4/17/4	80/-	Gas { 4 p.c. Ord.	98—102	53—59	56,—57½
2,600,000	"	"	8¼	26/8	Light { 3½ p.c. max.	70—79	44—46	44
4,962,325	"	"	4	4%	and { 4 p.c. Con. Pref.	96—99	64—67	64—65½
4,674,850	"	Dec. 11	8	8%	Coke { 3 p.c. Con. Deb.	72½—74½	50—52*	50½
180,000	"	"	10	10%	10 p.c. Bonds	..	..	..
89,500	"	Sept. 11	5	4½%	Hastings & St. L. 5 p.c.	..	57—62	..
858,140	"	"	8½	2½%	Do. 3½ p.c	37—39	40—45	..
70,800	10	April 25	11	7%	Hongkong & China, Ltd.	16½—16½	8½—9½	..
85,600	Stk.	Aug. 28	9	8½%	Hornsey 7 p.c.	..	90—95	..
151,000	"	Sept. 11	7½	5½%	Ilford A and C.	151—154	88—98	..
65,750	"	"	6½	4½%	Do. B	115—118	67—72	..
66,500	"	June 27	4	4%	Do. 4 p.c. Deb.	92—94	61—64	..
4,948,000	"	May 14	9	4½%	Imperial Continental	156—160	134—139	135—137½
1,925,000	"	Aug. 14	8½	8½%	Do. 3½ p.c. Deb. Red.	84—86	81—85	83
935,243	"	Sept. 11	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	86—91	..
2,498,985	"	Feb. 26	10	42/6	Liverpool 5 p.c. Ord. { A	211—213	..	..
						146—148		..
806,088	"	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	..
155,726	"	Aug. 14	7/5/6	32%	Maidstone 5 p.c.	..	56—61	..
75,000	5	June 11	5	5%	Malta & Mediterranean	4¼—4¾	1½—2½	..
350,000	100	Oct. 1	4½	4½%	Met. of Melbourne { 4½ p.c. Deb.	99—101	90—97	..
541,920	Stk.	Nov. 27	4	5%	Monte Video, Ltd.	11½—13	73—78	77½
1,875,822	"	July 30	4½	8½%	Newcastle&Gateh'd Con.	98½—99½	69—70	..
339,705	"	June 27	8½	8½%	Do. 3½ p.c. Deb.	82—83	57—68	..
15,000	10	Sept. 11	—	11%	North Middlesex 10 p.c.	..	10½—13½	..
85,240	10	"	7/14/0	7%	" 7 p.c.	14—15	9—9¾	..
800,000	Stk.	Nov. 27	8	8%	Oriental, Ltd.	117—122	102—105	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7¾	4¾—5½	..
60,000	50	Aug. 28	18	7½%	Parisian, Island B	125—131	80—86	..
100,000	50	"	12	6½%	Do. C	118—121	54—57	..
849,980	5	April 29	5	—	Primitiva Ord.	5½—6	1½—2	33/9
499,950	5	June 26	5	—	Do. 5 p.c. Pref.	4½—5	3—3½	62/6—65/-
521,600	100	Dec. 1	4	4%	Do. 4 p.c. Deb.	97—98	70—72	71¾
600,000	Stk.	July 30	4	4%	Do. " 1911	..	49—52	50½—50¾
846,198	"	June 27	4	4%	River Plate 4 p.c. Deb.	85—87	49—52	..
150,000	10	Sept. 26	6	6/-	San Paulo { 5 p.c. Pref.	10½—11	7½—8	..
125,000	50	July 2	5	5%	{ 5 p.c. Deb.	47—49	40—42	..
135,000	Stk.	Aug. 28	10	5%	Sheffield A	228—234	75—80	..
209,984	"	"	10	5%	Do. B	222—224	75—80	..
528,500	"	"	10	4½%	Do. C	220—222	75—80	..
133,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	Oct. 15	9	10%	South African	10½—11½	12—13	..
6,609,895	Stk.	Aug. 14	5/4/0	30/-	South Met. 4 p.c. Ord.	111—113	66—69	57½—57½
250,000	"	July 11	—	5%	Do. Pref.	..	94—96	..
1,895,445	"	"	8	8%	Do. 3 p.c. Deb.	72½—74½	51—54	..
234,820	"	Aug. 14	8½	5%	South Shields Con. Stk.	157—159	104—106	..
962,795	"	"	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	68—73	..
187,658	Stk.	June 27	5	5%	Do. 5 p.c. Deb. Stk.	116—118	80—85	..
647,740	"	Nov. 18	7½	3½%	Southampton Ord.	99—102	61—63	..
121,275	"	June 27	4	4%	Do. 4 p.c. Deb. Stk.	..	63—65	..
190,000	"	Aug. 14	..	4½%	Tottenham { A 5 p.c.	135—138	70—75	..
782,275	"	"	6	3½%	District { B 3½ p.c.	115—117	50—55	..
181,255	"	Dec. 11	4	4%	{ 4 p.c. Deb.	87—89	63—65*	..
189,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	..
295,476	Stk.	Sept. 26	5	3½%	Tynemouth 5 p.c. max.	103½—109	74—76	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	"	Aug. 28	8½	55/-	Wandsworth A 5 p.c.	151—156	85 90	..
355,638	"	"	6½	40/-	Do. B 3½ p.c.	129—134	63—68	..
108,075	"	"	—	38/6	Do. C	..	63—68	..
140,855	"	"	—	38/6	New Ordinary	..	63—68	..
269,000	"	"	6½	38/9	Wimbledon 5 p.c.	117—122	65—70	..
98,000	"	"	6½	40/-	Epsom 5 p.c.	121—126	65—70	..
88,416	"	June 27	3	3%	3 p.c. Deb. Stk.	55—59	49—51	..

* Ex Div.

At Christmas, Tralee was again in darkness, owing to a second strike of the gas stokers, on a wages claim.

National Dyes, Ltd., has been registered with a capital of £350,000 to carry on business as manufacturers of dyes, coal tar, oils, &c.

The Bolton Gas Committee are considering the advisability of providing a staff to adjust not only gas stoves and cookers, but incandescent lights. This will cost about £4000 a year.

The Halifax Gas Committee have decided to ask the Corporation to permit the appointment of six lady inspectors to visit houses and assist housewives in obtaining the best results from their gas-fittings, and to suggest any improvements that may be necessary.

The Swinton and Mexborough Gas Board Bill has received the Royal Assent.

Frank Schofield, a dyers' labourer, of Bradford, was found dead at his home last week, with an overcoat thrown over his head, and in his mouth the end of a pipe connected with a gas-bracket. The gas was turned on. He had been out of work for some weeks.

In some notes on co-partnership issued in an attractive form by Messrs. Clarke, Nickolls, and Coombs, Ltd.—who head the booklet "The Proof of the Pudding"—there is reprinted, by permission of the Labour Co-Partnership Association, a brief summary of schemes adopted by gas companies, several of which have, unfortunately, been in abeyance because of the war.

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OXIDE LIMITED, Brentford, MIDDLESEX.

EXTENSIONS.—Gas-Works requiring Alterations or Additions should Communicate with FIRTH BLAKELEY, SONS, AND CO., LIMITED, 15, Park Row, Leeds, who make a Speciality of Gas Apparatus, Coke-Oven Plant, and Structural Steel Work. Inquiries Solicited. Satisfaction Guaranteed. Telephone No. 22579, LEEDS.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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BENZOL PLANTS FOR GAS-WORKS.

BAGLEY, MILLS, & CO., Ltd.,
92, Victoria Street, Westminster, S.W. 1, Invite inquiries from all Gas-Works making 75 million cubic feet and upwards per annum.

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SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENCER CHAPMAN & MESSEL, LTD., with which is amalgamated WM. PEARCE & SONS, LTD., Mark Lane, LONDON, E.C. Works—SILVERTOWN.
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SATURATORS and all LEAD and TIMBER WORK in connection with Sulphate Plants.
We Guarantee promptness with efficiency for Repairs.
JOSEPH TAYLOR AND CO., CHEMICAL PLANT ENGINEERS, BOLTON, LANCS.
Telegrams—"SATURATORS, BOLTON." Telephone 0848.

ALDER AND MACKAY, LTD.
(ESTABLISHED 1850.)
WET AND DRY METERS,
SLOT AND ORDINARY.
STREET LAMPS AND AUTOMATIC CONTROLLERS.
EDINBURGH.
(See p. 743.)

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SPENT OXIDE BOUGHT.
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Phone: Avenue 6680.

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BALE & CHURCH, LTD.
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Phone: Avenue 6680.

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Tins for Sale to Consumers.
In Bulk for Works Use.
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BRITISH GAS PURIFYING MATERIAL.
ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON.
SPENT OXIDE BOUGHT.
BRITISH GAS PURIFYING
MATERIALS CO., LTD.
(W. T. P. CUNNINGHAM, Chief Proprietor and Managing Director.)
13, ARCADIAN GARDENS, WOOD GREEN, LONDON, N. 22.
Telegrams: "Briquimat, Wood, London."
'Phone: Palmer's Green 608.

SPENCER'S Patent Inclined HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement Nov. 18, p. 400.

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CARBURETTED HYDROGEN PLANT
for 300 to 500 B.Th.U.
COMPLETE GASIFICATION OF COAL.
BALE AND HARDY, LTD.,
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J. E. C. LORD, Ship Canal Tar-Works, Weaste, Manchester. Pitch, Creosote, Benzols, Toluol, Naphtha, Pyridine, all kinds of Cresylic Acid Carbolic Acid, Sulphate of Ammonia, &c.

ROBERT DEMPSTER & SONS, Ltd., ELLAND, Gas Engineers and Contractors for CARBONIZING PLANTS on Horizontal or Vertical Principles, and Stoking Machinery. HANDLING INSTALLATIONS, including Coal Breaking, Elevating, Conveying Plants and Coke Screening, Storing and Telpherage Plants. PURIFICATION.—All Branches of Wet and Dry Purification. STORAGE.—Gasholders, and all forms of Gas Apparatus. Wire: "DEMPSTER, ELLAND." 'Phones: ELLAND 261, 262, 263.

APPOINTMENTS, &c., VACANT.

WHEN Filling Vacancies, please REMEMBER THE CLAIM OF THE EX-SERVICE MAN, who, other Qualifications being equal, has the FIRST CALL ON YOUR CONSIDERATION.

THE Portsea Island Gas Light Company require a SUPERINTENDENT for their Flat-house Gas-Works, Portsmouth. Applicants must have had an Engineering Training and possess a Thorough Knowledge of Stoking and Electrical Machinery, Vertical Retorts, and Water-Gas Plants.

Salary, inclusive of War Bonus, £325 per Annum with free House.

Applications, stating Age, full Particulars of Experience and Qualifications, and enclosing *Copies* of two recent Testimonials, to be Delivered to the undersigned not later than the 3rd of January, 1920.

T. CARMICHAEL.

Gas Offices,
Town Hall Square,
Portsmouth.

COUNTY BOROUGH OF STOKE-ON-TRENT.
(GAS DEPARTMENT.)

THE Gas Committee require the services of a CHIEF DISTRIBUTION SUPERINTENDENT to Take Control, under the Chief Engineer, of the Distribution Department.

Applicants must be Experienced in all Up-to-Date Methods of Distribution, including High Pressure Supply, and be capable of Advising Consumers in the use of Modern Gas Appliance.

Applications, stating Age, Experience, accompanied by *copies* of three recent Testimonials, stating Salary required, to be sent to the undersigned, endorsed "Chief Distribution Superintendent," on or before Jan. 9, 1920.

A. MACKAY,
Chief Engineer and General Manager.
Gas Offices, Longton, Stoke-on-Trent,
Dec. 19, 1919.

THE Warrington Corporation Gas Committee require a WORKS SUPERINTENDENT with Good Practical Knowledge of Machine Stoking and General Gas-Works Routine. Salary, £260 per Annum.

Applications to be in Jan. 10, 1920.

W. S. HADDOCK,
General Manager.

Gas Offices,
Mersey Street..

SOUTH SHIELDS GAS COMPANY.

WANTED — General Foreman for Distribution Department. Applicants must be Practical Tradesmen, Experienced in all Branches of Distribution Work, including Mains and Services, Gas-Heated Hot Water Appliances, High-Pressure Gas Installations, and be able to Investigate and Remedy Consumers' Complaints.

Applications, stating Age, Wages required, and giving Full Particulars of Training and Experience, along with References, to be sent to the DISTRIBUTION SUPERINTENDENT, GAS-WORKS, SOUTH SHIELDS.

WANTED, a Competent Working MANAGER to Take Charge of Small Gas-Works.

Send full Particulars of Qualifications, Age, if Married, Salary expected, and *copies* of recent Testimonials to N. H. HUMPHRYS, 5, WYNDHAM ROAD, SALISBURY.

CAPABLE Clerk Wanted—Good know- ledge of Commercial Book-Keeping and Costs. Man of Tact and Resolution. Good Education. Knowledge of Shorthand preferred.

Write, with *copies* of Three recent Testimonials (one from present Employer), stating Age (not to exceed 35 Years), if Married or Single—Salary according to ability—to Mr. W. FISH, Secretary, ALDERSHOT GAS, WATER, AND DISTRICT LIGHTING COMPANY, VICTORIA ROAD, ALDERSHOT.

THE Derby Gas Light and Coke Company require a WORKS FOREMAN for their Cavendish Street Works. Make, 350 Millions.

Applicants should possess good Mechanical Knowledge, be familiar with D.B. Machinery, and be able to Control Men.

WANTED—Experienced Main and SERVICE LAYER; also Two METER REPAIRERS. Only fully qualified men need apply. Wages, according to Ability and Experience.

Apply to the CHIEF ENGINEER, Gas Offices, LONGTON, Stoke-on-Trent.

WANTED.—Two or three Gas-Fitters (owing to Housing Difficulties Single men preferred), with Good Practical knowledge of up-to-date Gas-Fitting in all its branches.

Only good men need apply to No. 6815, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

APPOINTMENTS, &c., WANTED.

EX-OFFICER, recently Demobilized, DESIRES POSITION in Gas-Works, Home or Abroad. Good Training in Large Works in North. Excellent Testimonials.

Address No. 6809, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

EX-OFFICER desires Tuition in Gas Engineering and Supply under Government Scheme on Works of Medium Size. Elementary previous Experience, and thoroughly understands Gas Company Accounts. Premium if required.

Address No. 6819, care of Mr. KING 11, Bolt Court, FLEET STREET, E.C. 4.

PLANT, &c., FOR SALE & WANTED.

MACHINE TOOLS for Immediate Delivery.

One new Brown & Sharpe No. 14 Plain GRINDING MACHINE, 12 in. by 80 in.

One No. 8A Warner & Swasey Auto Turret LATHE, all-geared Head. As new.

Two new Cincinnati Acme Capstan LATHES, 1½ in. capacity, auto Feed to Capstan.

Eight new Wells Capstan LATHES, ½ in. capacity, ¾ in. Hollow Spindle.

One new Richards Type Turret Boring LATHE, admit 32 in. Diameter in Gap.

One 26 in. swing Darling & Sellers Boring and Surfacing LATHE, 8 ft. bed. As new.

One new 9 in. stroke SLOTTING MACHINE.

One 12 in. stroke SLOTTING MACHINE. As new.

Three 8 in. centre by 6 ft. bed Lang SSS & Sc. LATHE. As new.

Six 10½ in. centre by 10 ft. Straight Bed Lang SSS & Sc. LATHES. As new,

One 18½ in. centre by 16 ft. bed Lund SSS & Sc. LATHE. As new.

Three new Universal Tool and Cutter GRINDERS.

Five Wet Tool GRINDERS. As new.

Full Particulars on Application to the JUDSON-JACKSON COMPANY, LTD., 50, MARSHAM STREET, WESTMINSTER, S.W. 1.

FOR SALE.—

(1) TOWER SCRUBBER, 18 ft. high by 3 ft. diameter, complete with Ladder, Water Apparatus, Valves, 3 in. Connections.

(2) Cast-Iron Round STATION METER, 1200 c.ft. per hour, complete with 4 in. Connections, Bye-Pass, and Valves.

(3) Two Glenboig RETORTS (New), 21 in. by 16 in. by 9 ft. 6 in.

(4) Small Cast-Iron Luteless PURIFIER, 5 ft. by 5 ft. by 10 ft., complete with Valves, &c.

All the above Plant is in good order.

For further Particulars apply to R. SCOTT, Esq., Gas Engineer, Gas-Works, NEWTOWNARDS, IRELAND.

THE Directors of the Sheppy Gas Company have for Disposal BENZOL RECOVERY PLANT (Messrs. J. & E. Hall, Ltd., Engineers, Dartford).

Offers to be sent to the MANAGER, 22, The Broadway, Sheerness, from whom full Particulars may be obtained.

FOR SALE — Gasholder, Two-Lift, of the Gadd and Mason Spiral-Guided Type. Capacity, 60,000 Cubic Feet.

DIMENSIONS—
Steel Tank, 46 ft. 6 in. diameter by 21 ft. 6 in. deep.
Outer Lift, 45 ft. diameter by 21 ft. deep.
Inner Lift, 42 ft. 10½ in. diameter by 21 ft. deep.
Rise of Dome Shaped Crown, about 2 ft. 1½ in.

Complete with Valves and Connections and Safety Apparatus.

Absolutely new.

The NORTH-EASTERN STEEL COMPANY, LTD., MIDDLESBROUGH.

SPENT Oxide Required — Prompt DELIVERY.

State Quantities for Disposal with Lowest Price and Best Terms, &c., to No. 6817, care of Mr. KING, 11, Bolt Court, FLEET STREET, E.C. 4.

TO Gas and Electricity Works.—You cannot Complete your Works without using CHARKHAM'S Chemically Cleaned, Washed, Sterilized, and Calendered MACHINERY WIPING MATERIAL—no Wrinkles. Packed in ½ cwt. pressed bales at 68s. per cwt.; ¼ cwt. Sample sent Carriage Paid to any Districts on receipt of your Cheque for 30s. Provincial Inquiries invited. The Wipers are famous for cleanliness. Send us your orders and we will do the rest.

J. CHARKHAM, Arthur Street, ALDERSHOT.
Telephone Aldershot 60.

CONTRACTS OPEN.

CORPORATION OF CALCUTTA.

NOTICE TO CONTRACTORS.

LIGHTING STORES FOR THE YEAR 1920-21.

TENDERS are invited, in duplicate, for the Supply and Delivery of LIGHTING STORES for Public Street Lamps and Municipal Institutions for Twelve months from April 1, 1920.

Complete Specification and Descriptive List of Stores required, together with Tender Form, in duplicate, may be obtained from the Central Record-Keeper, Central Municipal Office Buildings, Calcutta, on payment of Rs. 2 only.

The following is a brief summary of the principal articles required:—

(*a*) Inverted Incandescent GAS MANTLES for Street Lighting.
(*b*) Inverted Incandescent GAS BURNERS complete.
(*c*) GLASS CYLINDERS for Inverted Burners.
(*d*) GLASS PANES for Street Lamps.
(*e*) Inverted Incandescent GAS ARC LAMPS.
(*f*) BRASS NIPPLES of sizes for Gas-Burners.

Samples are required where stated in the List, and these must be addressed to the Superintendent of Stores to the Corporation, 149, Lower Circular Road, Calcutta, carriage paid.

Tenders must include Delivery Free of all Charges at the Corporation Stores, Calcutta, including Duty and Insurance against Breakages. War Risk Insurance and Extra Freight Charges (if any) to be separately stated.

The Corporation do not bind themselves to accept the lowest or any Tender, and will be at liberty to accept the whole or part of a Tender.

Tenderers may quote for any or all of the items mentioned in the List.

Payment will be made when Delivery is accepted.

Tenders must be addressed to, and will be received by, the Deputy Chairman of the Corporation up to 2 p.m. on Monday, the 15th of March, 1920, when they will be opened in the presence of such Tenderers as may be present.

Tender, in duplicate, must be enclosed in a Sealed Cover and superscribed "Tender for Lighting Stores for 1920-21."

No Tender will be considered unless accompanied by a remittance to the extent of 2½ p.ct. on the total value of such Tender.

Tenderers must abide by the rules in regard to Tenders in vogue in the Corporation, and are required to submit Tenders, in duplicate, on the Corporation Form above referred to.

The rates quoted in the Tender will remain open for acceptance for a period of six weeks from the date of opening the same.

J. C. MUKERJEA,
Secretary to the Corporation.
Central Municipal Office,
Nov. 26, 1919.

COMPANY NOTICE.

THE GAS LIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, SO FAR AS THEY RELATE TO CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 6th day of January next, and will be RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company, to be held on Friday, the 6th day of February next.

By order,
WILLIAM LYLE GALBRAITH,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W. 1, Dec. 22, 1919.

STOCKS AND SHARES.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that they hold PERIODICAL SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES.

Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to MESSRS. A. & W. RICHARDS, at 37, WALBROOK, E.C. 4.

CARBURINE & BENZOL FOR GAS ENRICHING

ALSO
THE MAXIM PATENT CARBURETTOR.

For Prices, &c., apply to
The GAS LIGHTING IMPROVEMENT CO., Ltd.
SALISBURY HOUSE, LONDON WALL, E.C.
Telephones: 4451, 4452, 4453, and 4454 London Wall.
Telegraphic Address: "Carburine, London."

GAS JOURNAL

LIGHT ♦ HEAT ♦ POWER ♦ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CXLVIII. No. 2955.] LONDON, DECEMBER 30, 1919. [71ST YEAR. PRICE 8d.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER,
Gas Engineers' Agents and Contractors for METERS, FIRE-CLAY GOODS, OXIDE OF IRON, AND ALL OTHER GAS APPARATUS.
Inquiries Solicited.
Telegrams—"DARWINIAN, MANCHESTER."
Telephone—3268 & 3269 City (two lines).

'BUFFALO' INJECTOR

Operated Entirely by One Handle.
Class A lifts 24 ft.
Class B lifts 12 ft.
SEND FOR LIST.
Telegrams: "Temperature London." Tel. No. 12,455 Central.
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THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.
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CAST IRON PIPES
FOR
GAS, WATER, & STEAM
1½in. to 12in. BORE.
THOS. ALLAN & SONS, LTD.,
Bonlea Foundry,
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Telegrams: "BONLEA, THORNABY-ON-TEES."

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MANUFACTURERS OF
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GLAZED BRICKS AND PORCELAIN BATHS.

COAL TAR PITCH
of best and unvarying quality.

CREOSOTE & CARBOLIC OILS. NAPHTHALENES.

BENZOL PRODUCTS:
Pure 90's and Standard Benzol. Pure and Commercial Toluol.
Light and Heavy Solvents. 65% Crude Benzol.

BEST MOTOR BENZOL in large or small quantities.

SULPHATE OF AMMONIA.

SIMON-CARVES LD., MANCHESTER.
Telegrams:—"SIMCAR, MANCHESTER." Telephone:—8200 CITY (6 lines).

CHAMBER CARBONIZATION

WITH

KOPPERS' CHAMBER OVENS

IS THE MOST EFFICIENT

AND MOST ECONOMICAL SYSTEM OF

GAS PRODUCTION.

KOPPERS' PROCESS

OF

DIRECT RECOVERY OF AMMONIA FOR GAS-WORKS.

In this system the scrubbing process is entirely dispensed with, and the Ammonia is recovered direct from the Gas in the form of Sulphate.

ADVANTAGES OF KOPPERS' DIRECT RECOVERY PROCESS.

INCREASED YIELD OF SULPHATE.
GREAT SAVING IN STEAM CONSUMPTION.
REDUCTION IN WATER CONSUMPTION
PLANT IS SIMPLE TO OPERATE.
EFFLUENT LIQUOR REDUCED TO A MINIMUM.
EXCELLENT QUALITY OF SULPHATE PRODUCED

FULL PARTICULARS ON APPLICATION TO THE

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Telephone: No. 1331 (two lines) Telegrams: "KOCHS SHEFFIELD."

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STOKING MACHINES

ARE NOW
FITTED WITH

Separate Travelling

Motor & Stop-Plate

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INCREASING SPEED OF
WORK AND WEIGHT
—— OF CHARGE ——

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MANY EXISTING MACHINES ALREADY FITTED

ALDRIDGE & RANKEN,
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ALDRIDGE & RANKEN,
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FOR PERFECT MANTLES
USE THE WORLD-FAMED

LINDSAY THORIUM

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THOMAS PIGGOTT
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T P & Co Ltd ATLAS WORKS BIRMINGHAM

GAS PLANT.

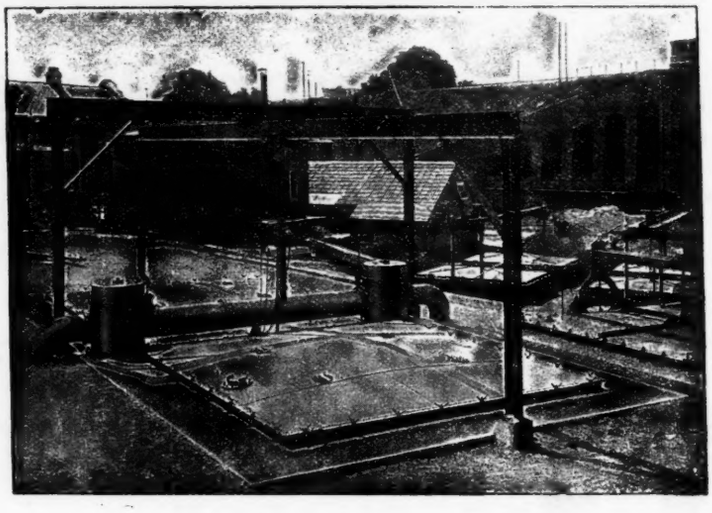
Gasholders with or without Guide Framing

Barker's Patent Spiral.

Complete Gas Plants.

Steel Pipes welded or rivetted.

Tanks, pressed steel, also rivetted or welded.



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Motor Spirit Plant.

Sulphate of Ammonia Plant

Benzol Plant.

Naphthalene Plants, pressed and pure.

Stills for Tar, Ammonia, Benzol, & Phenol.

Condensers & Dephlegmators

HIGH PRESSURE GAS PLANTS

BOOSTING FANS, ROTARY & RECIPROCATING COMPRESSORS,
DISTRICT & SERVICE GOVERNORS.

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GAS MANTLES

The largest manufacturers of Gas Mantles in the British Empire.

ENTIRELY **BRITISH.**

MANTLES FOR ALL SYSTEMS of High and Low Pressure Gas Lighting.

PROPRIETARY BRANDS— "Ironclad," "Evening Star," "Iris," "Dreadnought," "Aladdin," &c.

Specially Manufactured for Gas Companies. **Unequalled for strength and durability.**

Head Office: CANNON STREET HOUSE, E.C. 4.

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We Invite Enquiries for

INCANDESCENT

GAS BURNERS

(UPRIGHT & INVERTED)

AND ALL TYPES OF

GAS PENDANTS, BRACKETS, &c.

WE ARE ACTUAL MANUFACTURERS, AND GIVE PERSONAL ATTENTION TO THE REQUIREMENTS OF THE TRADE.

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Telegrams: "SHADOWLESS BARB LONDON." Telephone: City 8668.

And at Newcastle-on-Tyne, Bolton, Birmingham, & Sydney, N.S.W.

JOHN BROWN & CO., LTD., Colliery Offices: **ROUNDWOOD, Nr. ROTHERHAM.**

OWNERS OF THE FAMOUS

Aldwarke, Rotherham, & Dalton Main Gas Coals

As used by the principal Gas Companies of the World.

ALSO PRODUCERS OF THE BEST SOUTH YORKSHIRE ASSOCIATED HARDS (BARNSLEY BED).

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Workmanship and Materials of the Highest Quality.

PECKETT'S LOCOMOTIVES.

Built to any Specification or Gauge.

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"OXIDE, MANCHESTER."

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All Bye-Products from the Distillation of Coal dealt with.

SPECIALITIES { Hydrated Oxide of Iron for Gas Purification, and of different Strengths to suit conditions of Purification, Sulphuric Acid (free from Arsenic) for Sulphate of Ammonia Manufacture, Recovered Sulphur, and Prussiates of Soda, Spent Oxide bought on Sulphur and Cyanide Contents, Tar and Gas Liquor purchased. *See our Advertisement last week.*

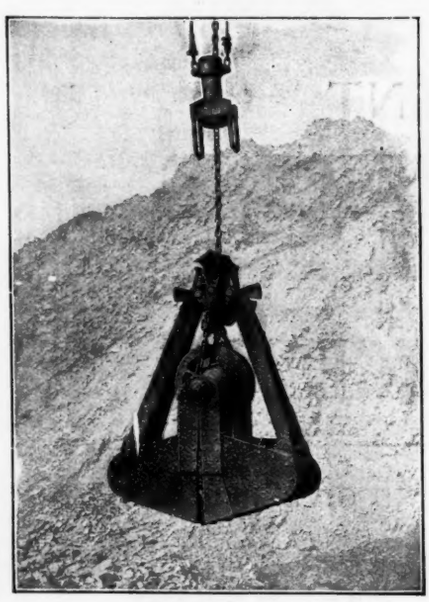

Fig. 1257. CLOSED.

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FOR

COAL, COKE, SLAG,

ETC.

(PETERS' PATENTS)

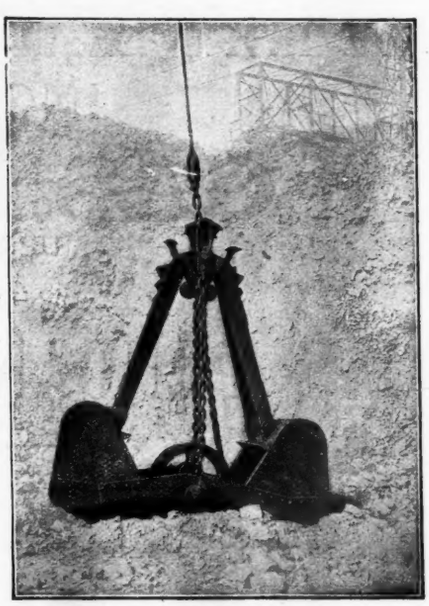

Fig. 1256. OPEN.

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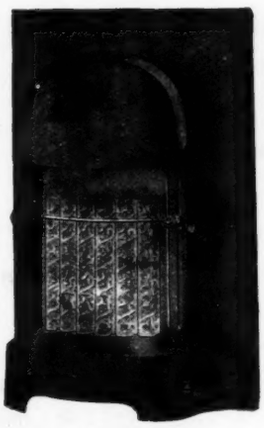
SUITABLE FOR HOUSING SCHEMES.

Gas may be used with economy in Artisans' Dwellings, and its use is recommended by High Authorities.



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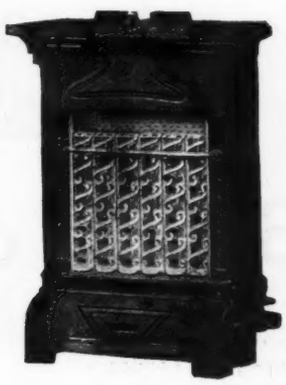

"Como" A Fire
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"Lanca" No. 3 Cooker on Cast Stand

"Vortex" Circulator.

FLETCHER, RUSSELL & CO., LTD. WARRINGTON, MANCHESTER, and LONDON.

TULLY'S PATENT
CARBURETTED HYDROGEN
GAS PLANT

For 300 to 500 B.T.U. GAS

COMPLETE GASIFICATION OF COAL

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EVERYTHING in GAS LIGHTING MATERIAL

Veritas Mantles, Crystal and Coloured Glassware, Pendants and Brackets, Small Brass Fittings, Ukay Inverted Lanterns, &c., &c.

We invite applications for the following Sectional Catalogues recently issued if not already received:—

No. 431. Veritas Incandescent Burners, Mantles and Accessories.

No. 437. Gas Fittings.

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Falk, Stadelmann, & Co. LTD.

VERITAS LIGHT WORKS

LONDON GLASGOW MANCHESTER

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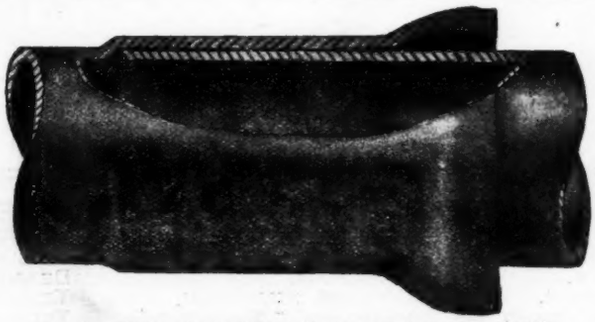

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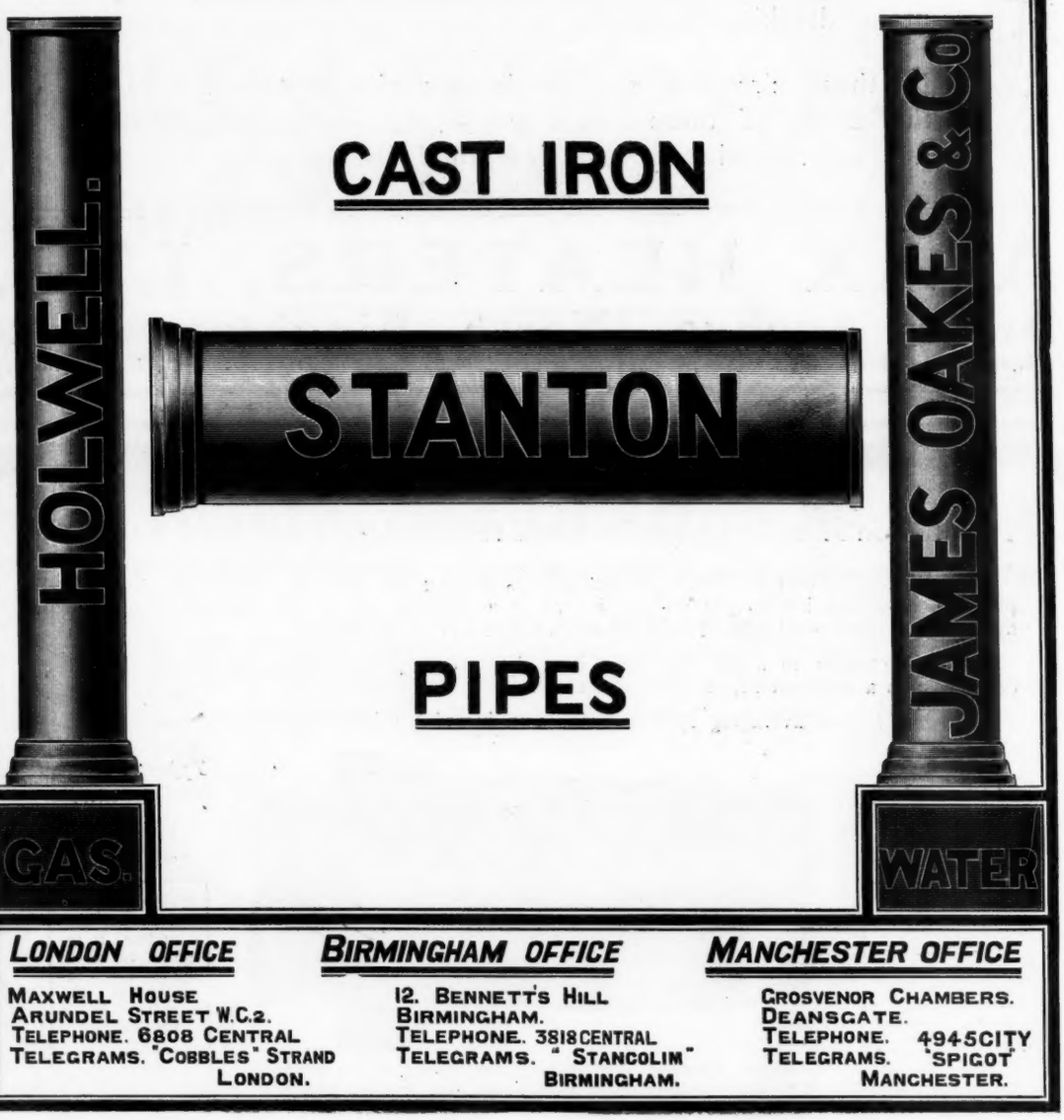

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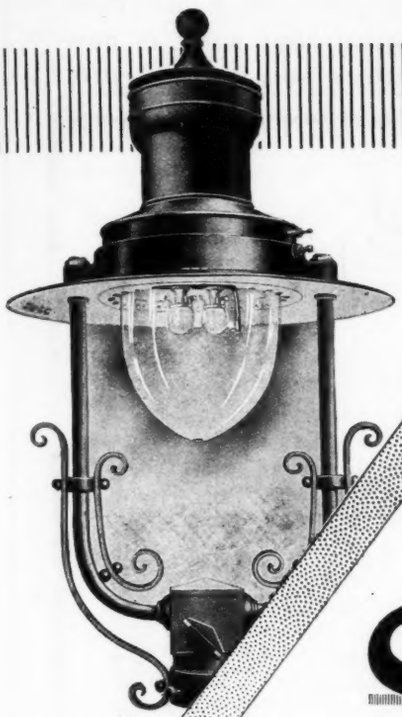

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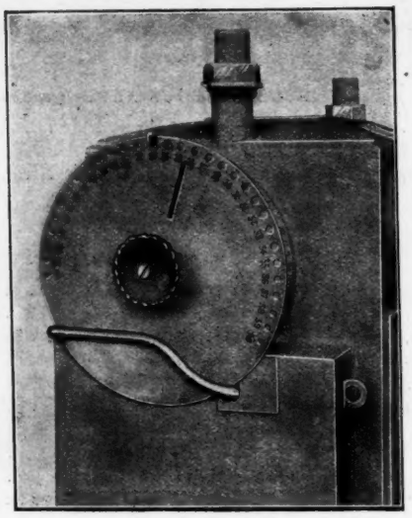

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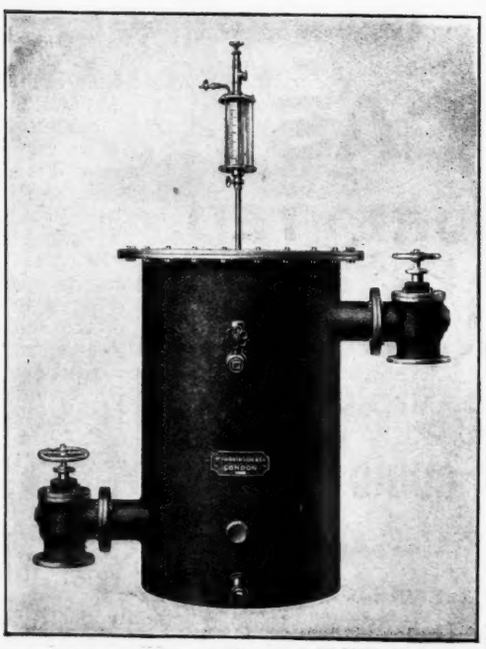

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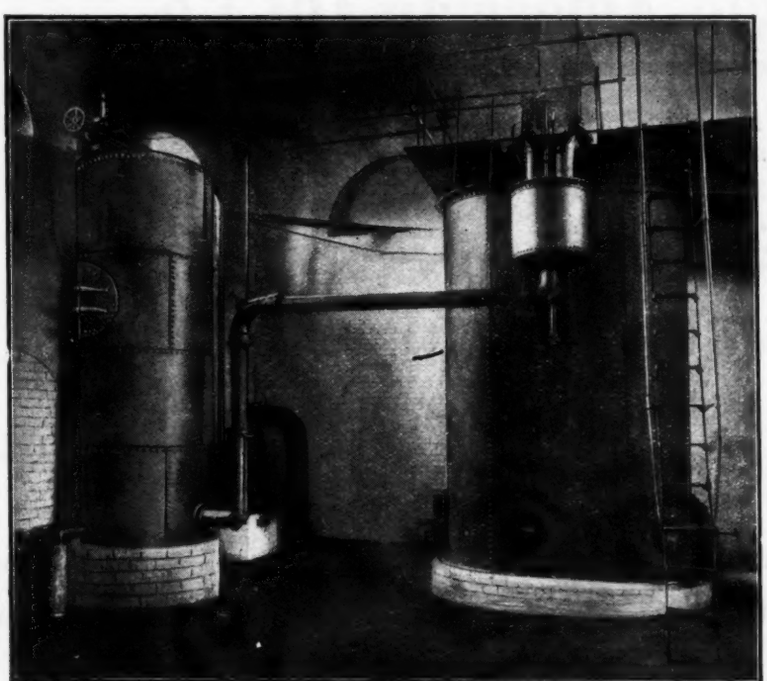

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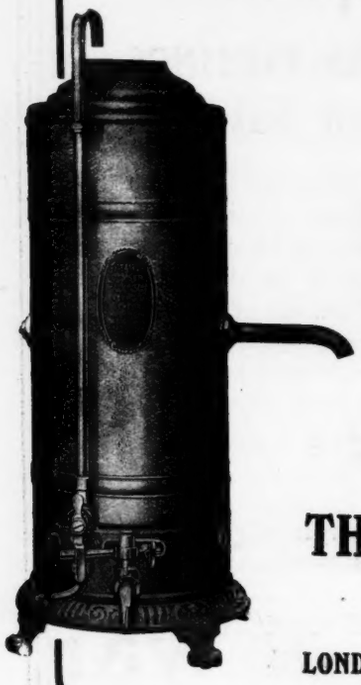

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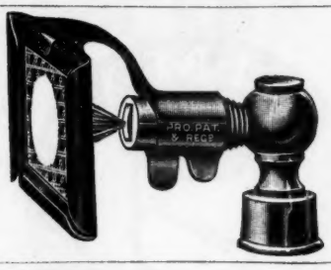

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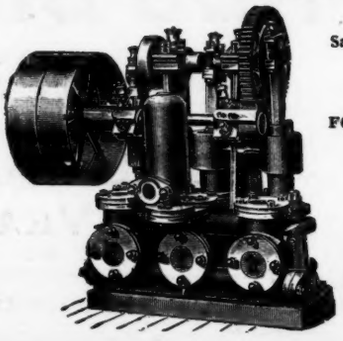

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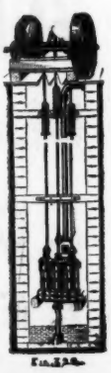

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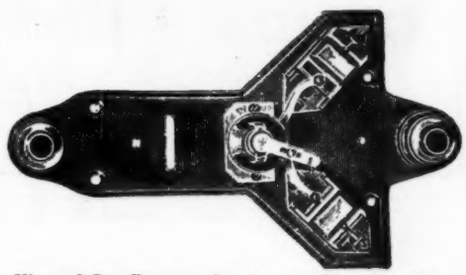

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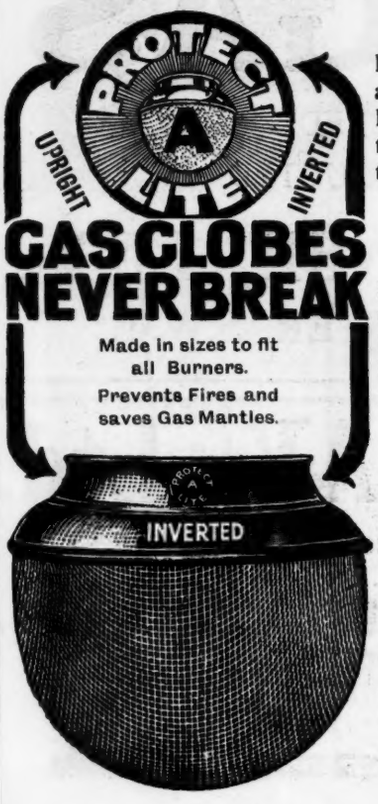

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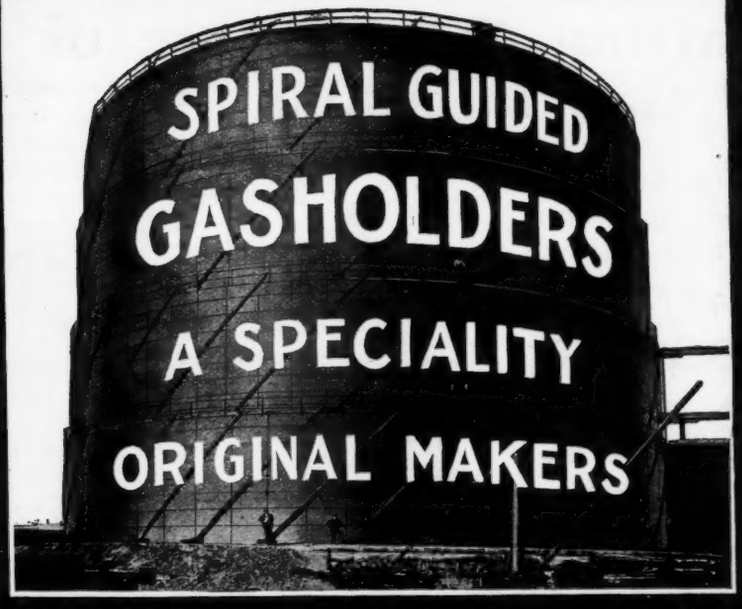

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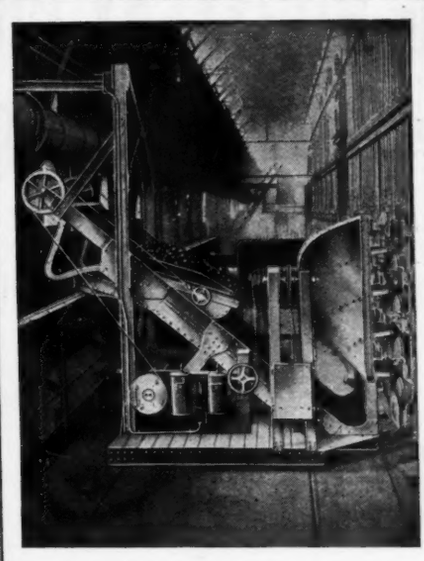

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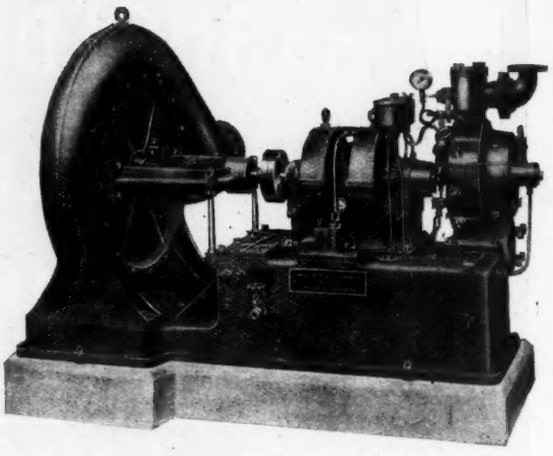

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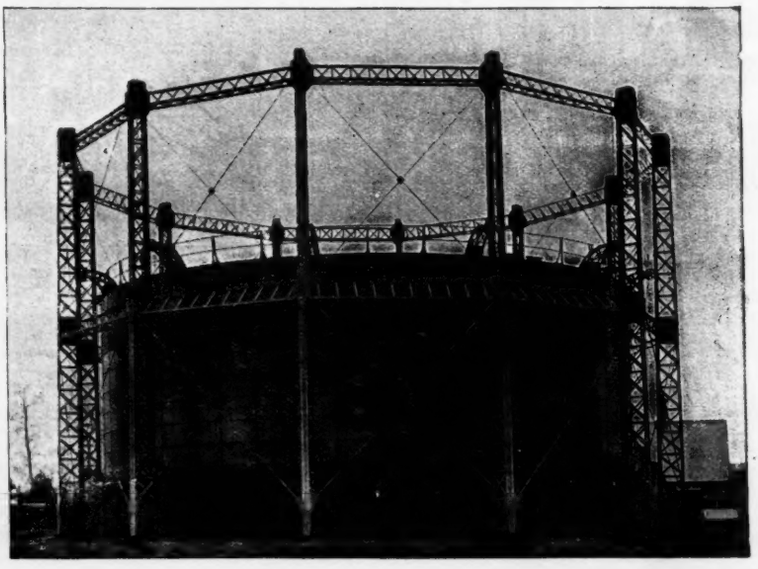

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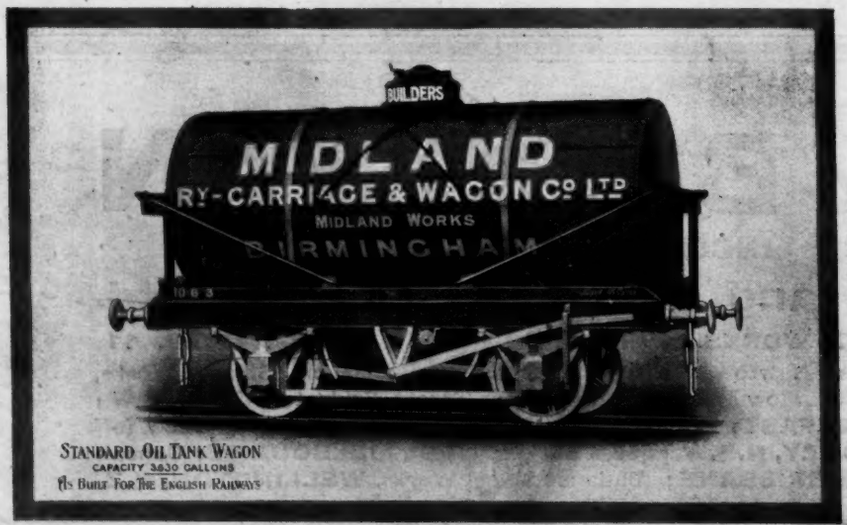

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